february, 1961

nlgi spokesman

journal of the national lubricating grease institute

Introducing NLGI's New Promotion Character

Aero/Space Grease Requirement Trends

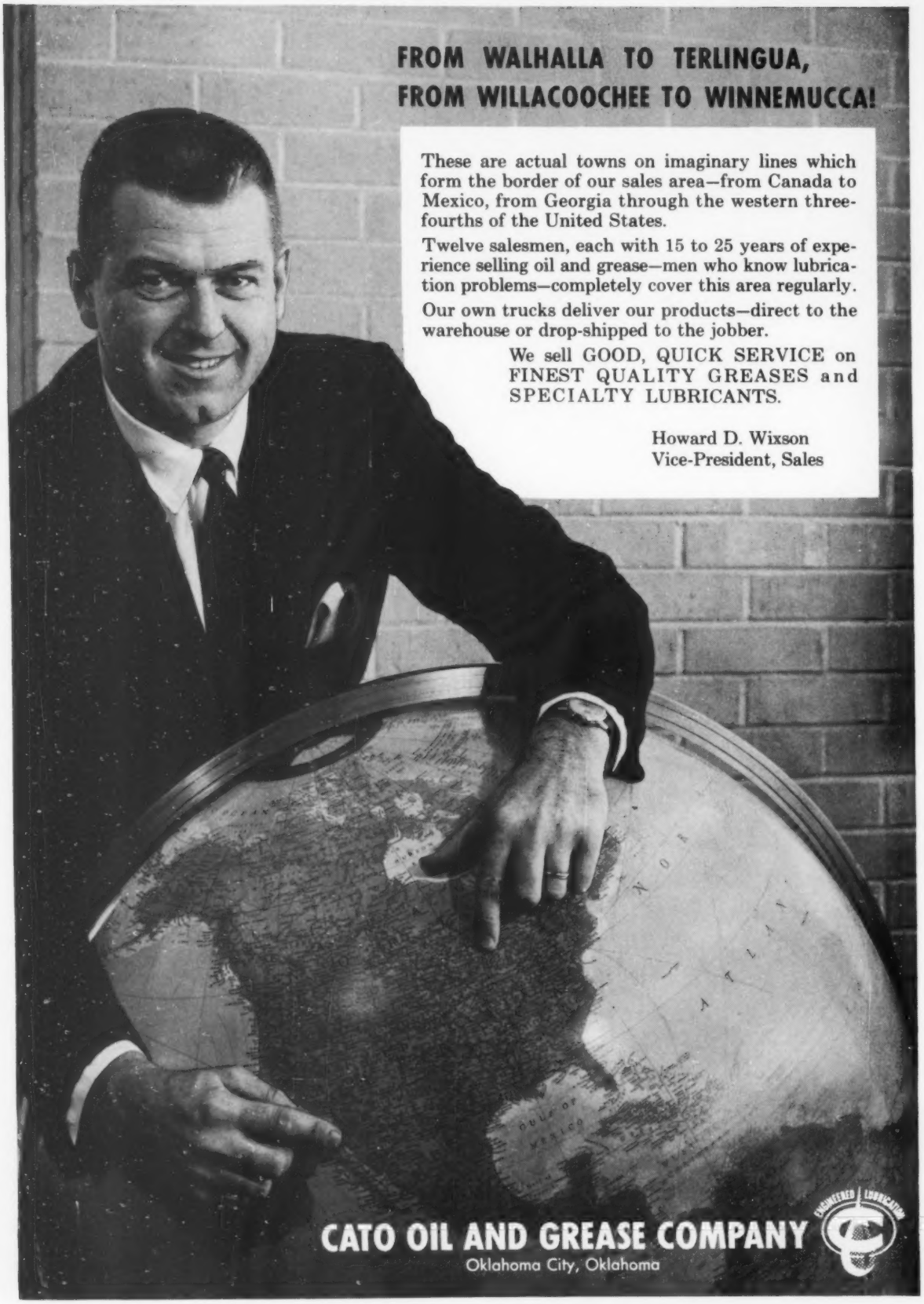
By D. N. HARRIS

Rapid Method for Predicting the Flow Properties of Lubricating Greases

By C. F. CARTER

Selling the Lubricating Grease Market

By C. L. JOHNSON


FROM WALHALLA TO TERLINGUA,
FROM WILLACOOCHEE TO WINNEMUCCA!
These are actual towns on imaginary lines which form the border of our sales area—from Canada to Mexico, from Georgia through the western three-fourths of the United States.
Twelve salesmen, each with 15 to 25 years of experience selling oil and grease—men who know lubrication problems—completely cover this area regularly.
Our own trucks deliver our products—direct to the warehouse or drop-shipped to the jobber.
We sell GOOD, QUICK SERVICE on FINEST QUALITY GREASES and SPECIALTY LUBRICANTS.
Howard D. Wixson
Vice-President, Sales
CATO OIL AND GREASE COMPANY
Oklahoma City, Oklahoma
ENGINEERED LUBRICATION

nlgi spokesman

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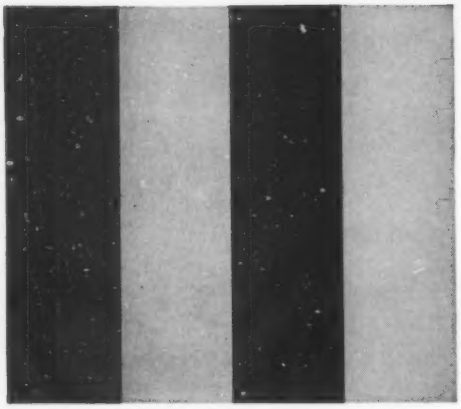
IN THIS ISSUE

THE COVER

CHARACTERS that tell a sales story are not new, but the lubricating grease industry has never employed one to promote the many advantages which come with getting the car up on the lube rack... until now, that is. With this issue of the journal, the Institute introduces a registered character for use by members, to be used as NLGI member firms see fit, in a variety of ways...advertising, sales promotion, public relations, etc. As yet unnamed, our little man can go to work for you immediately, telling his story to the motorist at a glance ...naming will follow, in a contest which is explained on page 426 of this issue.



NLGI PRESIDENT'S PAGE

By F. R. HART, *President*

Our Expanding Market

A recent issue of a San Francisco newspaper contained an article describing the progress being made to mechanize the farm. This article told of seven new machines, all grease lubricated, that soon will be in regular use for the growing of tomatoes, strawberries, apricots, grapes, sugar beets, etc.

I was interested in learning more about these developments, and here is what I found.

The matter of producing food is complicated with all of the economic problems found in any other business. Farmers, like we people, are looking for a better way of operating their business–profitably. Their search has led to the development of new machines. Machines capable of doing the job quicker, better, and at a fraction of the usual cost. Herein lies their answer to a more profitable business. Herein also lies the assurance we need that the market for lubricating grease is growing–not declining.

I also found that the agricultural engineers of such state universities as Michigan, Cornell, Indiana, California and Illinois, are working with farmers and equipment manufacturers in the development of many completely new farm machines. For example, the Agricultural division of the University of California collaborated with the Blackwell Manufacturing Co. of Rio Vista in the invention of a tomato harvester. This machine harvests tender skin tomatoes without a bruise or a blemish. This year, some twenty of these machines will be in service, with hundreds more to follow. They are lubricated with grease. Another unusual machine is the grape harvester, which quickly strips luscious table and wine grapes from the vine without damage. Still, another development is a device that mechanically thins young sugar beets, formerly a back-breaking job. There are many others, such as the garlic harvester, the mechanical rake used in gathering walnuts, and the mechanical strawberry planter.

What does this mean to us in NLGI? Just this:

The development and use of new mechanical devices expands the demand for lubricating greases. A good way to meet this growing demand would be to match machine developments with new and improved lubricants.

The time to develop these products is now!

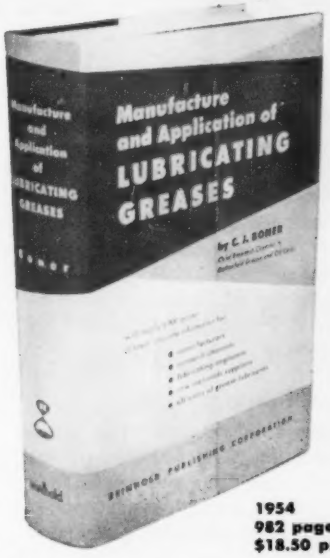
Available!

Manufacture and Application of

LUBRICATING GREASES

by C. J. Boner

Chief Research Chemist
Battenfeld Grease and Oil Corp.



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FACT-FILLED PAGES
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23
BIG CHAPTERS

Here in one giant volume . . . the most complete storehouse of information ever published on the composition, properties and uses of lubricating greases!

The book begins by describing in detail the structure and theory of lubricating greases. Then follow chapters on the various raw materials, processes and manufacturing equipment. Lubricants containing specific thickeners, including such recent developments as lithium soaps, complex soaps and non-soap gelling agents, receive special attention.

Of major interest is the large section on present uses and future trends of lubricating grease products. Here you'll find the complete details of when, where, and how to apply a specific lubricant for any given purpose.

Everyone concerned with the preparation or use of grease lubricants will find Boner's book of enormous practical value. Manufacturers and lubricating engineers will find here a complete breakdown of the effects of each ingredient of treatment upon the characteristics of the final product, and a full explanation of the physical and chemical methods used in measuring these characteristics. Suppliers of fats, oils, additives, thickeners and other raw materials will gain new ideas for future product research and development. In addition, users of grease products will learn the properties of available lubricants and the major purposes that each fulfills.

MAIL THIS HANDY ORDER COUPON TODAY!

NLGI SPOKESMAN
4638 J. C. Nichols Parkway
Kansas City 12, Missouri

Please rush me a copy of Boner's MANUFACTURE AND APPLICATION OF LUBRICATING GREASES.

☐ I am enclosing $18.50
☐ Company Purchase Order

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News About NLGI

Witco Assumes Active Membership in NLGI

Witco Chemical company of New York has assumed the Active member affiliation of Sonneborn Chemical and Refining, which Witco, a former Associate member, had purchased last year. R. Cubicciotti and J. Faust will continue as Company and Technical representatives, respectively.

Annual Audit

Member firms receiving questionnaires on services billed by the Institute will recognize the annual audit, conducted by Arthur Anderson company, certified public accountants.

This procedure is followed each year to insure the membership that the organization is run according to the best business practices and procedures.

February Board Meeting

There will be a meeting of the NLGI board of directors on Wednesday, February 15, 1961, at the O'Hare Inn in Des Plaines, Ill.

Foil Stickers Showing NLGI's New Promotion Character Now Available

Metal foil seals employing NLGI's new little registered character are now available to NLGI members. The little man tells the industry's message, "Give your car a lift . . . Inspect every 1,000 miles . . . for safety, comfort and savings," in bright red, blue and black colors, backed up by the aluminum foil of the sticker itself.

The seals may be purchased by member firms by writing the national office . . . they are ten dollars per thousand, and are boxed to that quantity. Same day service will be given to orders. There are a number of uses for these bright stickers . . . stationery, envelopes, special mailings, etc. More information may be obtained elsewhere in this issue.

New Emery Representative

Emery Industries of Cincinnati, an NLGI Associate member, has named David R. Eagleson, sales manager of the fatty acid division, as their Company representative. He replaced G. W. Boyd, who has been made general manager of the division.

Technical Representative For California Texas

California Texas Oil corporation of New York, an NLGI Marketing member, has named L. Langworthy as Technical representative to the Institute.

Technical Committee Column

CHAIRMAN L. C. BRUNSTRUM
Senior Research Associate
Research & Development Dept.
American Oil Company
P. O. Box 431
Whiting, Ind.

Grease Research Must Be Shared

I quote the following excerpts, with as much accuracy as my memory permits, from recent discussions on the subject of grease research:

". . . this paper is a fine example of research in a field that needs so much basic work." Dr. C. R. Singleterry, Naval Research Laboratory.

"It is desirable to do grease research for about a year and then get out before it gets in one's blood." Dr. E. O. Forster, Esso Research and Development Co.

"We are grateful to the large petroleum laboratories for their basic grease research." Malcom Ambler, British American Oil Co., Ltd.

"There is a limit to the amount of grease research we can do, no matter how attractive the subject." Dr. C. M. Loane, Research and Development Department, Standard Oil Co. (Indiana).

These qualified authorities see grease research as a field that is sorely needed, interesting to the point of becoming an obsession, yet hindered by the commercial necessity for a small budget. There is a bright spot in this picture: the 1960 fundamental research session on rheology, microscopy, phase studies, and permeability dovetailed very nicely to the benefit of all. Only by such sharing of the load and the results can the grease industry hope to accomplish the job.

INTRODUCING . . .

NLGI'S NEW PROMOTION CHARACTER

New Registered Figure Designed for Maximum Utility In Advertising, Sales Promotion, Public Relations

"The Lubricating Grease Industry has need for a registered character which will at once remind the viewer of the products and services we offer. . ." This was the assignment given NLGI's Chassis Lubrication Committee last year, headed by Chairman J. W. Lane of Socony Mobil Oil Company, Inc.

A top New York industrial design firm undertook the task under Lane's guidance and the process of devising a friendly, informative character which would tell a sales story at a glance was begun. He had to have personality, impact, and be reproducible in a number of ways, much like "Reddy Kilowatt," which practically everyone recognizes instantly as representing the electric energy industry.

Fortunately, some of the groundwork had been done by previous committees and development began to move along, with frequent consultations followed by a full-dress presentation last fall to the NLGI Board of Directors. The slight modifications made at that time were incorporated in the final design, which was approved and presented to the membership at the last annual meeting.

As an instant reminder our little man incorporates a number of desirable qualities, not the least of which is his friendly appearance. . .being friendly certainly is an asset. He is also distinctive and eye-catching. He can do a selling job on his own if he has to and yet will blend well in any company's advertising and customer relations efforts. A copy line tells the lube bay story in the "Give Your Car a Lift" with an auto on the grease rack as part of his upper design. Wide enough for the industry's traditional 1,000 mile message to be printed in a strong reverse across his body, he makes a strong appeal for inspection for a number of motivating reasons. . ."For Safety, Comfort and Savings."

(The word "Inspect" was felt to tie in more closely with petroleum industry consumer trends. Provisions have been made for alternate words: "Car Care" and the familiar "Lubricate" may be inserted in later issues, in lieu of "Inspect.")

In making available to its members a personalized,

registered character, the Institute now offers a symbol which can be employed in a number of visual media ...from possible postage meter imprints on mailing, to direct mail pieces such as blotters–for metal foil stickers which have myriad uses, to full-scale employment in advertising layouts. Although the character is registered by the Institute, there are no restrictions to employment by member firms. As yet unnamed, the character is the focal point of the contest for NLGI SPOKESMAN readers (see below) who are being urged to enter names for a prize.

This new service is a marketing aid and photo prints of the artwork will be mailed upon request. Two versions of the character are available–black and white, or a three-color separation of red, blue and black. Reproductions can be made any size by artwork obtained from the national office. Metal foil stickers are now available and these, too, may be ordered through the national office. These metal foil stickers will be supplied in black, red and blue on silver; the silver effect being supplied by the foil stock itself. A price list and announcement has been sent to members on the foil stickers, now that they are ready for distribution. Companies are urged to begin vigorous merchandising by putting the Institute's character to immediate use in every way possible. ■

Win Money! Make History! Have Fun!

Contest Begins to Name NLGI'S New Little Registered Character

Now you, too, can be an ad man...and maybe win some money in the process. The NLGI SPOKESMAN is offering $50 to some frustrated lubrication man who wants to turn copywriter. The winner will come up with a winning name for the little registered character introduced on page 425 and cover, who will help spearhead the industry's drive to get motorists aware of the need for car care–via periodic inspection in the lube bay.

Contest rules are simple. Any subscriber to the NLGI SPOKESMAN may submit up to five names ...each entry will be noted as to date of postmark in the event of duplication, and names may be sent to the NLGI national office up to Wednesday, May 10, 1961. The winner will be advised promptly and general announcements will be made shortly afterwards through the pages of the NLGI SPOKESMAN. No box tops, no jingles, no green stamp books...just one name might do it.

Several descriptive names have been suggested as samples...Looey, the Lube Inspector, Slippery Sam and Treat M. Right among others. Since the character will be employed in a variety of advertising, sales promotion and public relation functions, he needs a short, descriptive name, which is easily remembered. We think you can name him.

So sharpen up your pencils and start submitting. Don't forget to sign your name...as a grease lubrication man you will be helping your industry and you might even win $50, while having some fun doing it.

Aero/Space Grease Requirement Trends

By: D. N. Harris, Shell Oil Company

Presented at the NLGI 28th annual meeting in Chicago, October, 1960

TECHNICAL progress in the aero/space field has been, and will continue to be, very rapid. Unfortunately, the rate of progress has not been the same in all aspects of the vehicle design and it is therefore difficult to predict in detail the lubricant requirements for specific components. However, there is enough experience available to forecast trends and thereby to indicate probable future requirements.

The original request for this paper suggested the inclusion of industrial grease trends as well as presenting the future requirements for aircraft and space vehicles. The author does not feel sufficiently informed to discuss the industrial subject in detail. However, past experience indicates that the industrial designer can and does utilize specialized lubricants and greases which were originally developed for specific high performance aviation uses. The author believes this situation will continue in the future.

Now to begin with the forecasting of aero/space requirements.

First, it appears definite that commercial aviation will be operating supersonic aircraft within a relatively few years. The broad technical capabilities are in existence, although a great deal of detail design remains to be done. For instance, the decision has not been finalized whether the design speed will be Mach 2+ or Mach 3+, and although the difference in Mach No. seems small, the effect on grease requirements will be very significant. For those who may not be familiar with the term, "Mach No." is the ratio of the airplane speed to the speed of sound. Thus, a "Mach 2" airplane is flying at twice the speed of sound at the flight conditions. The supersonic aircraft is surrounded by air which has been heated to the stagnation temperature by impact compression. Depending upon the altitude and other operational factors, this temperature is approximately 250°F. at Mach 2, and about 600°F. at Mach 3.

Since the airplane is submerged in air at this temperature, all component parts must operate at this ambient temperature plus their normal operating temperature rise. The only exceptions to this condition will be passengers and such components as can justify the expenditure of energy to keep them cooled. Even by using lightweight insulation methods to reduce the heat flux into such components, the energy required to pump heat to the outside air will be expensive in weight and energy consumption. Thus, the designer will make every effort to design component parts so they will operate with a minimum of cooling. Furthermore, there will be many components, such as control surface bearings, which will be located in external areas of the airplane where cooling will be completely impractical. Because of space limitations in wings, etc., such bearings and other moving parts will be highly loaded, and therefore, highly dependent upon lubricant performance. Furthermore, it is probable that many of the lu-

brication points will be accessible only during major overhaul of the airframe, thus the original charge of grease will be expected to last for perhaps 1,000 hours without replenishment. The significance of the effect these temperatures will have upon grease property requirements is well appreciated because it is in this area that much of the base oil and thickener research has been expended during the past five to ten years.

However, there is another aspect of the supersonic airplane which will make the lubrication problem even more severe. In order to avoid shock wave damage on the ground and to reduce aerodynamic drag, it is estimated that such aircraft will fly at an altitude of at least 50,000 feet and perhaps as high as 90,000 feet. Thus, many lubrication points not located within the pressurized cabin will be operating at an ambient pressure of 0.1 to 0.02 atmosphere; and the pressures will be lowest during altitude cruise when air speeds and ram temperatures are highest. This drastically lowered pressure will increase the base oil evaporation significantly over that experienced under sea level testing conditions. Thus, greases which are marginally satisfactory at sea level will probably fail badly in actual service because of loss of oil. Unfortunately, base oil volatility is not a property which can be altered by small amounts of an additive and the bulk fluid itself must be altered to reduce the evaporation rate. Within a given class of fluid, this usually requires increased molecular weight with resulting increases in viscosity and poorer low temperature properties. It is predicted that a major research effort will be necessary to develop base fluids and thickeners which can be incorporated into satisfactory greases for the supersonic airplane. It is also foreseen that close cooperation will be required on the part of the equipment designer to adapt materials and design to best utilize available grease capabilities.

There are other aspects of the supersonic problem which are common to the space vehicle and these will be discussed later.

The present surge of space activity is so broad that it is almost impossible to be specific. Vehicles are being designed which will orbit the earth at relatively low altitudes, others quickly re-enter the atmosphere as a ballistic missile, and still others are being considered which will take years to complete the planned space trip. The payload will also vary from complex instruments to living beings, including man. The internal environments which will be provided will vary widely, and the lubricant property requirements will vary accordingly. However, perhaps a few general areas of interest can be discussed with benefit.

It would appear that the life span of ballistic missiles is too short to present any really severe problems which cannot be met by existing greases. Perhaps the most troublesome problem is that of stability during the period the missile is in "ready storage." This problem is not so much a requirement for improved storage life as it is a need for improved ability to accurately predict useful storage life. Too frequent servicing of ready missiles would be very costly, but too infrequent servicing could result in catastrophic failure.

Instrumented satellites and manned space vehicles will be operating under conditions which were unknown and unpredictable a year or two ago. However, much experience has been gained since then, and it develops that the problem of temperature control is relatively simple. By proper adjustment of heat radiating surfaces, the temperature of the vehicle interior can be maintained near normal room temperature. Furthermore, it has been found that exterior surfaces do not experience as extreme temperature variations as was originally thought possible. Presently available information indicates that a temperature range of —40 to +150°F. should be typical of the conditions experienced by an external bearing such as might be used for mounting a movable solar energy cell. Certainly, such temperatures are moderate in comparison with the requirements of the supersonic airplane.

Ambient pressures approach complete vacuum during actual space travel, with values of 10^{-12} to 10^{-16} mmHg considered to be typical. Although some interior equipment of manned vehicles may be maintained much nearer normal atmospheric pressure, many of the lubrication points will have to operate under these low pressure conditions as in the case of the supersonic airplane. A similar base oil evaporation problem will therefore exist, and although temperatures will be lower, the required service life may be much longer.

These conditions of nearly full vacuum may also pose a new problem area where experience is almost totally lacking. There is limited evidence which indicates metal oxide films are an important factor in the lubrication of moving surfaces and if the oxide films are not present the metal surfaces will weld together under simple pressure contact, causing scoring and early failure. Additives which can produce films to take over the function of the oxide films may be necessary to provide satisfactory long-term lubrication under space conditions.

Much publicity has been given to the cosmic radiation existing in space and much remains to be learned in this field. Research vehicles have found zones of high radiation intensity associated with the magnetic field of the earth. This zone, or belt, of high intensity has been termed the "Van Allen Belt" after the scientist who planned the experiments which located it. However, the present indications are that greases should not suffer appreciably from this source. A satellite operating within the Van Allen belt would accumulate a dosage of 10^5 Rads in two, or perhaps three years, but in the solar system outside this belt the flux density is much lower. Furthermore, the grease in a bearing would receive significant protection from the bearing and the bearing

housing, thus, the grease itself would be subjected to an even lower dosage. It would appear, therefore, that greases are presently available which are capable of withstanding the radiation aspects of space travel. Of course, radiation levels may be much higher near nuclear power plants, but the space factor will not introduce a radically new factor.

Miniaturization of component parts of nearly all systems is being accomplished to an amazing degree. This automatically entails miniaturization of the lubricating system for moving or rotating parts. Since greases have the inherent advantage of providing a self-contained lubrication system, it is predicted that designers will have a strong desire to increase the use of grease lubrication in future designs. Development of specialized greases will undoubtedly be required to meet specific future requirements.

Miniature bearings will be used increasingly in both rotating and oscillating applications. Usually, the equipment utilizing such bearings has limited power or torque available, yet the motions of the mechanisms must be precise and repeatable; sometimes after long periods of idleness. This normally means a demand for low starting torque greases and this requirement is in conflict with long life at high temperatures and low ambient pressure because of oil evaporation. Furthermore, there is increasing evidence that these small bearings require different grease properties than do the larger bearings upon which most of our experience has been gained. Therefore, it is likely that development of special greases for miniature bearings may be necessary.

Oscillating motion has been found to be more critical of some greases than normal rotational operation. More will need to be learned about the phenomena involved, and the results incorporated into future grease formulations.

Cleanliness, or dirt count, continues to increase in importance. Small bearings in particular would appreciate cleanliness levels that appear impractical for normal grease processing, packaging and application methods. New developments in all phases of raw material and grease processing and handling are likely to be needed.

Service reliability will be increasingly important for both the supersonic airplane and space vehicle. Failure of cabin pressurization equipment or of the automatic control systems of a supersonic airplane can be catastrophic in a matter of seconds. The space problem is even more severe. Some contemplated manned space trips will require over three years to complete. Failure of any essential component system would be disastrous and the weight penalty of carrying reserve component systems would be very costly. Critical components, therefore, must have an extremely high service reliability for this period because there are no overhaul bases or alternate landing fields enroute.

In all fields of aero/space grease application, the design savings and the reduction in maintenance costs possible with high performance greases will justify almost any conceivable grease cost. The amount of grease required in a given application is small, so high cost greases do not have a marked effect on the cost of the finished equipment. This aspect is mentioned because the author believes the designer and user of future equipment will gladly pay over $100/lb to cover the cost of developing, packaging and distributing specialized greases that provide superior performance in the particular application.

In summary, it is foreseen that greases will have an increasing advantage over other methods of lubrication in future compact, miniaturized systems. However, specialized greases will probably be required to provide the service reliability that will be required.

For supersonic aircraft, the wide temperature range and low ambient pressure under which the greases will have to operate will be a challenge which should spur research for new base oils and thickeners. The extremely low pressure conditions of space and the very long operating life necessary for such travel will probably pose the most severe problems for this new grease application of the future. Many lessons will have to be learned regarding lubrication under the conditions of nearly complete vacuum.

Certainly, potential applications for new greases developed in the future are many and they should justify continued research efforts to meet the challenge. ■

About the Author

D. N. Harris *graduated from the University of California with a BS degree in mechanical engineering in* 1936. *Later that year, he joined Shell Oil Co. in the Martinez motor laboratory and, in* 1939, *began general product application work. In* 1944 *he was transferred to the San Francisco head office where he began specialization in the aviation field. He was the aviation member of the Defense Dept. team sent to the Far East in* 1952 *to survey fuel and lubricant distribution and performance under combat conditions. In* 1955 *he assumed his present position as chief aviation engineer in the products application department of the New York head office. He is a member of Tau Beta Pi, SAE, IAS, the former NASA fuels subcommittee, the Defense Dept. committees on petroleum distribution methods and equipment and on aviation fuels and lubricants. He is chairman of the CRC fuels and lubricants committee.*

Presented at the NLGI 28th annual meeting in Chicago, October, 1960

Rapid Method The Flow Properties

By: C. F. Carter,

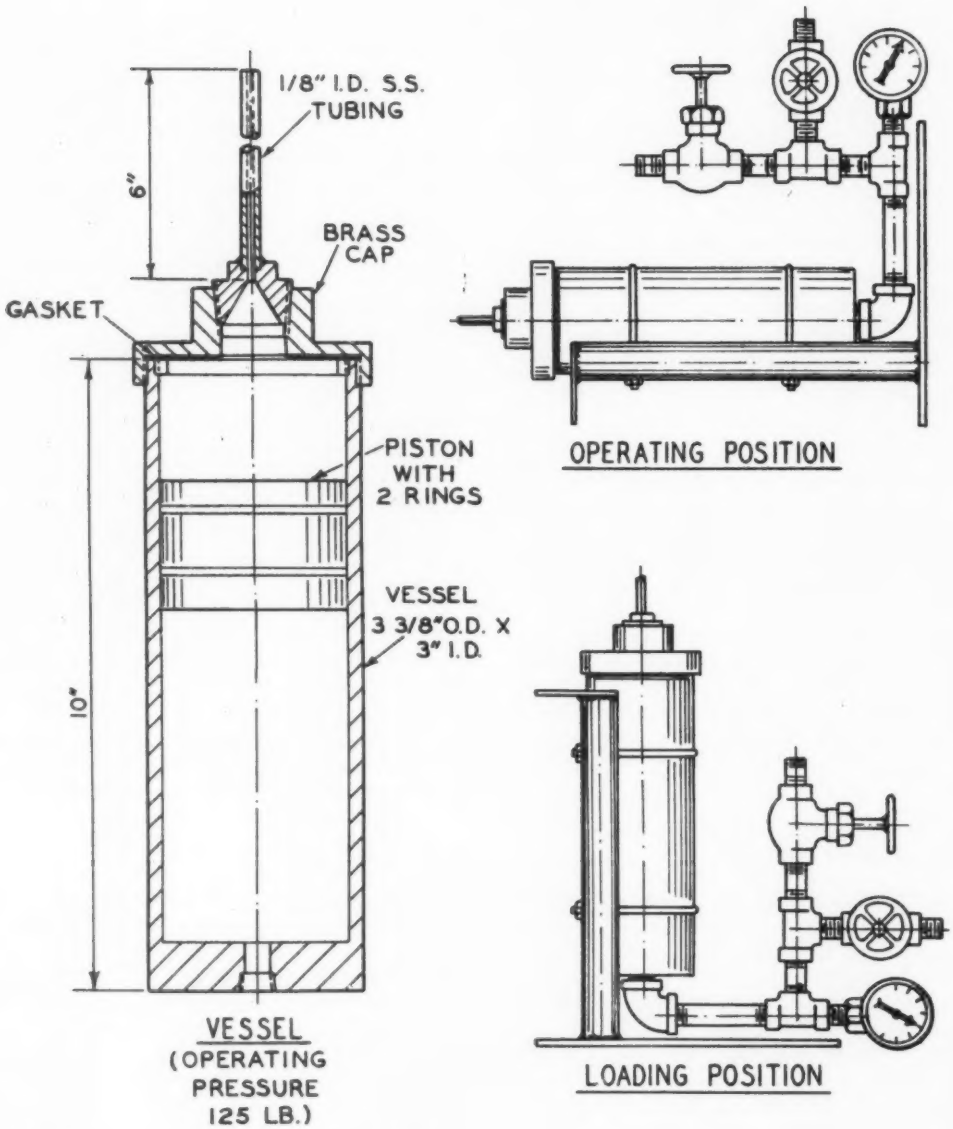

FIGURE 1—Schematic of pressure flow test equipment.

for Predicting of Lubricating Greases

California Research Corp.

THE DISPENSABILITY of a grease is a major consideration in its development. In many applications, a grease with excellent lubricating qualities cannot be used if its flow properties or pumpability is deficient. With the wide variety of thickeners and oils now being used in greases, it is difficult and costly to determine the flow properties of the many possible formulations. A number of empirical equations will approximately predict the flow rate of greases, but they contain constants normally dependent upon the thickener and usually derived from experimental flow data. These data are obtained by a method, such as the ASTM procedure for determining the apparent viscosity of greases. This method is time consuming and is more accurate than is generally required.

A rapid test for determining flow properties was developed to screen experimental greases in our research and development programs. It is used for control work for commercial production of greases and can be run as quickly as a worked penetration. This paper describes the pressure flow test equipment and how we are able to predict the pumpability of a grease, as well as other properties related to grease flow.

Description of the Apparatus

The apparatus consists of a pressure chamber and capillary tube, as shown in Figures 1 and 2. The cylinder is 3⅜ inches in diameter and 10 inches long. The ⅛ by 6-inch capillary is attached to the removable cap which screws on to the end of the cylinder. A floating piston equipped with rings is used to force the grease through the capillary and is actuated by compressed gas. The compressed gas, usually air throttled to a maximum operating pressure of 125 psi, is controlled either by a regulating valve or a bypass attached to the manifold. The apparatus is portable, weighing less than 16 pounds, and can be easily carried from the laboratory to the cold room or any other constant temperature area.

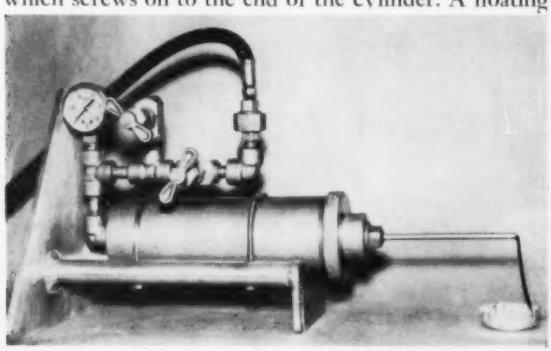

FIGURE 2—Pressure flow test equipment.

Procedure

The test is normally run at ambient temperature (77°F.) and at 36°F. However, tests can be conducted over a wide range of temperatures; and the tests are preferably run in a thermostated room.

A sample of grease, about 1 pound, is maintained at the test temperature for at least four hours. The grease is transferred to the test equipment and is forced through the capillary at various pressures. The extruded grease is collected in disposable paper cups or aluminum dishes for weighing. The duration of the test at each pressure is usually one to two minutes; and depending upon the particular problem, one to four test pressures are run. For predicting the pumpability of grease in commercial grease dispensers, operating pressures are selected so that the flow of the grease will be between 100 and 300 reciprocal seconds. Normally, the tests are run between 40 and 80 psi. Pressure flow tests are obtained over a wider range of pressures when apparent viscosity of the grease is required. If similar types of greases have previously been run, only one test pressure is required to predict the pumpability of the lubricant.

Repeatability Data

The repeatability of the pressure flow test as measured by the standard deviation is shown in Figure 3. The results of five measurements on five greases run under two sets of conditions by one operator in a single apparatus within a short interval of time show that the standard deviation is 3 per cent or less of the arithmetic mean.

Application

The data obtained by the pressure flow test can be applied in a number of ways as discussed below. The

	A				
	75° F and 50 psi				
Grease No.	19	20	21	22	23
	Flow (grams per minute)				
Run No.					
1	20.5	57.6	121.6	86.8	145.6
2	20.9	55.8	119.0	86.0	145.6
3	20.8	55.6	120.8	87.6	146.0
4	20.8	55.6	122.2	83.6	147.2
5	20.4	55.6	122.2	86.0	146.0
Arithmetic Mean	20.7	56.0	121.2	86.0	146.1
Standard Deviation					
grams per minute	0.22	0.88	1.34	1.50	0.66
% of Mean	1.1	1.6	1.1	1.7	0.5
	B				
	36° F and 75 psi				
Grease No.	19	20	21	22	23
	Flow (grams per minute)				
Run No.					
1	4.0	7.9	35.3	17.6	33.5
2	4.0	7.8	35.9	17.4	34.2
3	3.9	8.0	35.0	17.2	33.5
4	3.9	7.8	35.2	17.3	33.4
5	3.7	7.8	35.8	17.3	33.5
Arithmetic Mean	3.9	7.9	35.4	17.4	33.6
Standard Deviation					
grams per minute	0.12	0.10	0.39	0.16	0.33
% of Mean	3.1	1.3	1.1	0.9	1.0

FIGURE 3—Repeat measurements with pressure flow test.

applicability has been demonstrated on a variety of greases representing a wide range of properties as shown by the grease inspection test results in Figure 4.

High-Pressure Grease Gun With Short Line

Figure 5 shows that the pumpability of greases in a typical high-pressure grease gun with a ⅜-inch dispensing hose 10 feet long can be predicted with suitable accuracy from pressure flow data. The pressure flow data were obtained with 50 psi air pressure at 5-80°F. The commercial high-pressure grease gun was operated with 125 psi air pressure and at corresponding temperatures. A standard Zerk dispensing nozzle was attached to the end of the dispensing hose.

High-Pressure Grease Gun With Long Line

Figure 6 shows predictability of the pumpability of greases in a heavy-duty, high-pressure gun with 15 feet of ¾-inch pipe, 20 feet of ¼-inch hose and a Zerk dispensing nozzle. The pressure flow test data were obtained at 75 psi air pressure at 77°F. The grease gun operated with 150 psi air pressure at 74°F. This equipment is typical of that used for truck fleet lubrication.

Wheel Bearing Packer

Figure 7 shows the relation between pressure flow data and the flow of grease through a wheel bearing being packed with a wheel bearing packer. The test data were obtained at 36°F. A standard load of 65 foot-pounds was applied to the lever arm of the wheel bearing packer, and the time required to force the grease through a No. 15118 Timken bearing was measured.

Grease No.[1]	Thickener	Constituent Mineral Oil Viscosity, SSU At 100° F	At 210° F	Viscosity Index	Worked Penetration
1	Sodium Aluminum Stearate	582	64	80	420
2	Sodium Aluminum Stearate	636	68	80	370
3	Calcium Soap and Salt Complex	500	59.6	85	365
4	Calcium Soap and Salt Complex	350	53.5	85	395
5	Sodium GA-10[2]	500	61	85	345
6	Sodium GA-10[2]	900	79	85	290
7	Calcium Tallowate	551	63	83	370
8	Lithium-Calcium Stearate	1138	80	60	297
9	Lithium-12-Hydroxystearate	696	59	20	292
10	Lithium-Calcium Stearate	1070	77	50	285
11	Sodium Stearate	1283	77.5	30	275
12	Sodium Tallowate	2850	141	77	240
13	Lithium-Calcium Stearate	1135	80	59	290
14	Lithium-Calcium Stearate	1135	80	59	250
15	Calcium Soap and Salt Complex	500	59.6	85	306
16	Calcium Soap and Salt Complex	500	59.6	85	340
17	Sodium Aluminum Stearate	823	75	80	320
18	Sodium Aluminum Stearate	1000	82	80	280
19	Lithium-Calcium Stearate	1135	80	59	280
20	Barium-Tallowate	600	56.7	20	277
21	Calcium Soap and Salt Complex	350	54	85	340
22	Sodium Aluminum Stearate	636	68	80	360
23	Sodium Aluminum Stearate	582	64	80	410

[1] Reference number of test greases shown in Figures 3 to 9 inclusive.

[2] Sodium salt of Oronite GA-10, Methyl n-octadecylterephthalamate.

FIGURE 4—Composition and physical properties of the test greases.

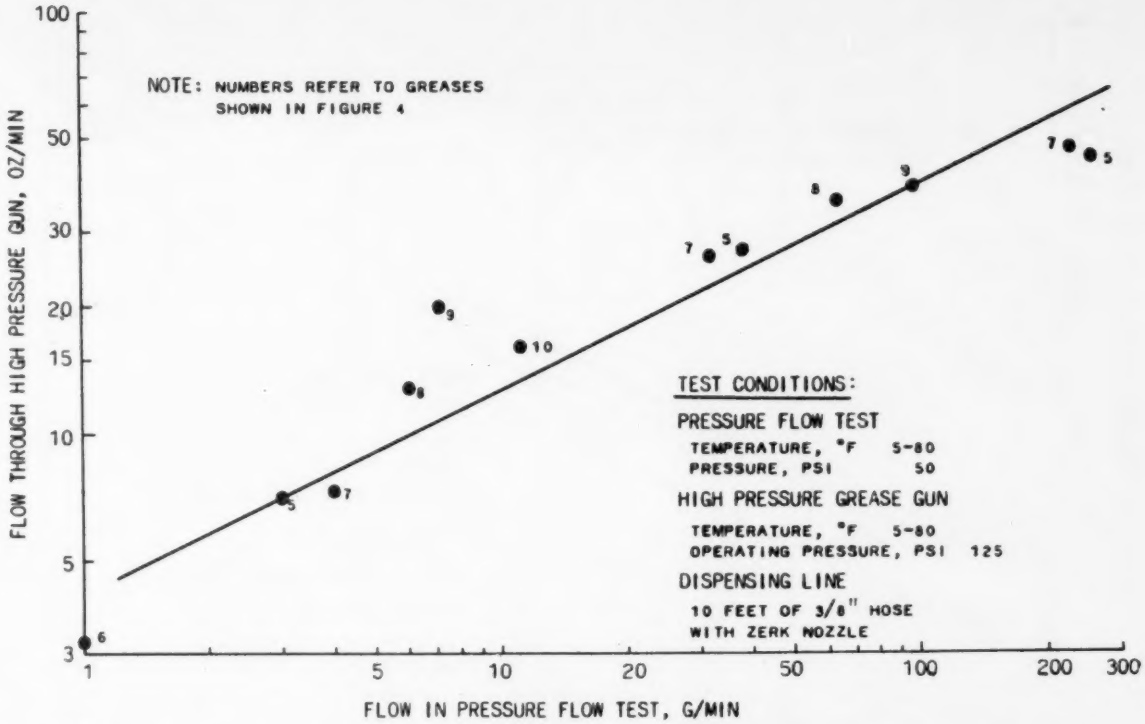

FIGURE 5—Grease flow rate correlation between pressure flow test and high pressure grease gun with 10 feet of hose.

Single-Line Automatic Lubrication System

The pressure flow test is also applicable for predicting pumpability of greases in single-line automatic lubrication systems. In this case, the flow at low shear rates, such as 1-10 sec^{-1}, is critical.[1] In contrast, the critical flow in automotive service stations and double-line industrial systems is at shear rates above 100 sec^{-1}. Figure 8 shows the apparent viscosity of several greases at 36°F. and at shear rates between 1 and 200 sec^{-1}. The data were obtained by measuring flow rates at pressures between 5 and 80 psi and calculating the apparent viscosity by the ASTM Method D 1092-58T.

Difficulty was encountered with Grease No. 3 in the winter by an account with a single-line centralized system. The longest dispensing line was 200 feet long and varied in size from 1-inch pipe to ¼-inch tubing. Grease No. 2 had previously been used in the summer and Grease No. 1 in the winter. The dispensing trouble with Grease No. 3 was due to the high apparent viscosity at low shear rates. The pressure flow test was used to develop Grease No. 4 which has eliminated the difficulty at the account throughout the year.

Bearing Torque

Limited data indicate a correlation between bearing torque and the pressure flow test results. Figure 9 shows the relation between flow data at 36°F. and the starting and running torque with a 204 Conrad-type ball bearing lubricated with the same grease at 36°F. The pressure flow test data were obtained with 80 psi air pressure, and the torque values were measured by the method described in Military Specification MIL-G-3278A. This relation is expected to be valid only for

About the Author

C. F. Carter *obtained his BA degree from Polytechnic College of Engineering in* 1934. *The following year he joined California Research Corp., subsidiary of Standard Oil Co. of California. For the past* 17 *years, Mr. Carter has been engaged in the development and manufacture of lubricating greases with California Research. An interested member of ASLE, he has been a frequent contributor to the* Spokesman.

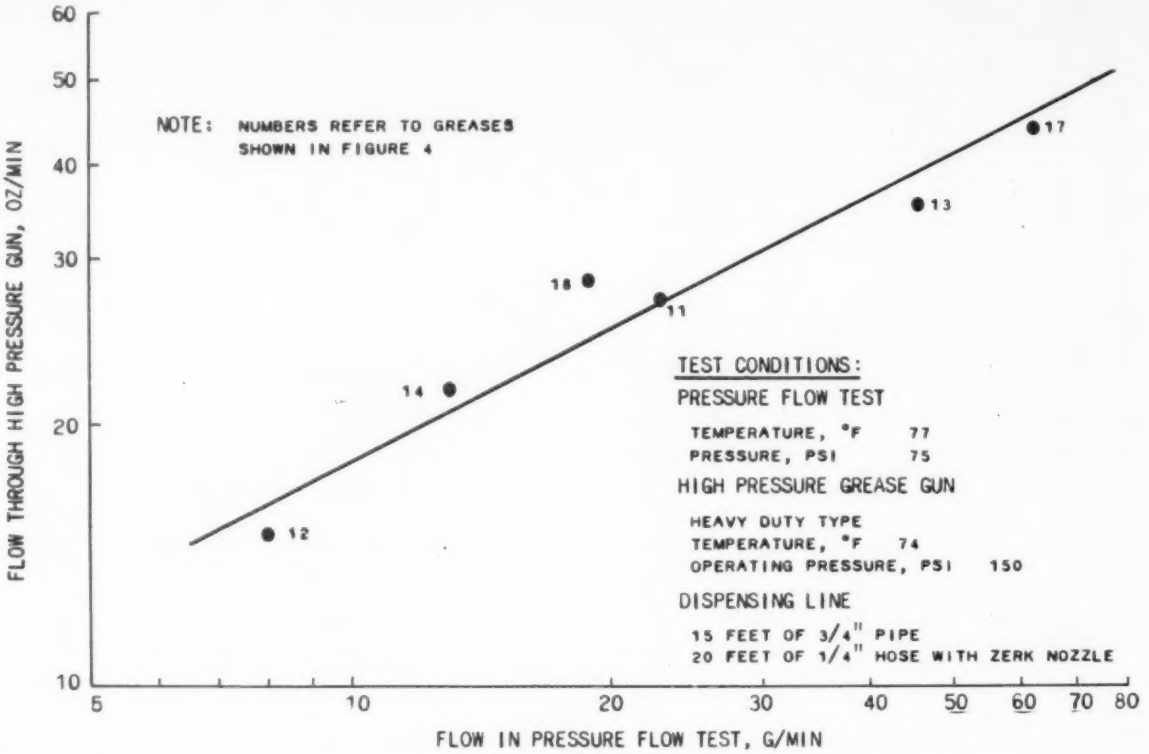

FIGURE 6—Grease flow rate correlation between pressure flow test and high pressure grease gun, 35 feet of dispensing line.

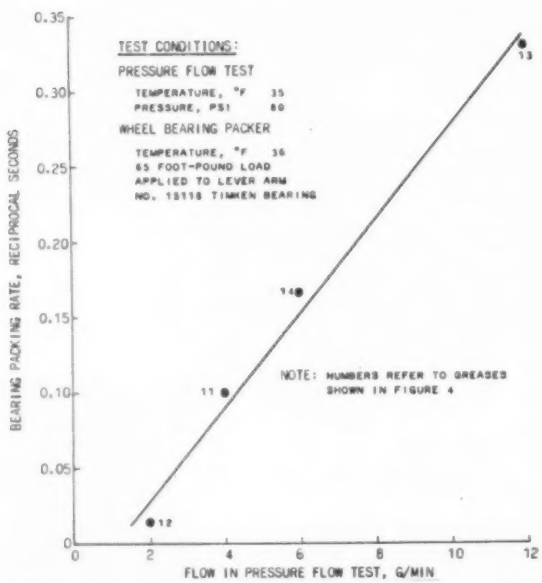

FIGURE 7—Packability of wheel bearing greases predicted from pressure flow test data.

the given greases. The pressure flow test is useful in screening greases after it has been established that the low temperature torque of similar greases is close to the values desired.

Determination of Constants for Empirical Equations for Grease Flow

The pressure flow test is a very useful method for determining constants for use in empirical equations for determining flow of greases under various conditions. At the 1957 NLGI meeting, Dr. D. W. Criddle of our company, explained the usefulness of his new flow equation for predicting grease flow.[2] The equation for grease flow, $\left(\frac{V}{t}\right)$, is expressed by:

$$\frac{V}{t} = ABC$$

Where:

A = The flow rate expected for the oil,
B = Correction for the volume fraction of the thickener, and
C = A term determined by the yield point and shear breakdown.

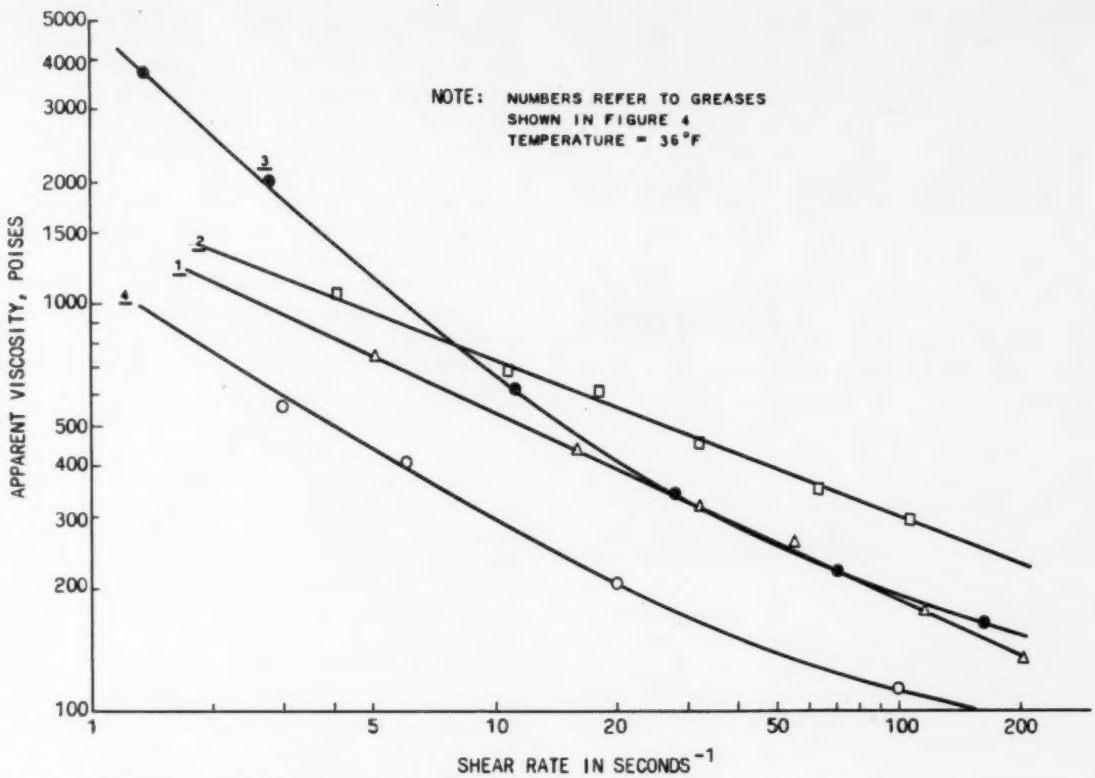

FIGURE 8—Apparent viscosity calculated from pressure flow test.

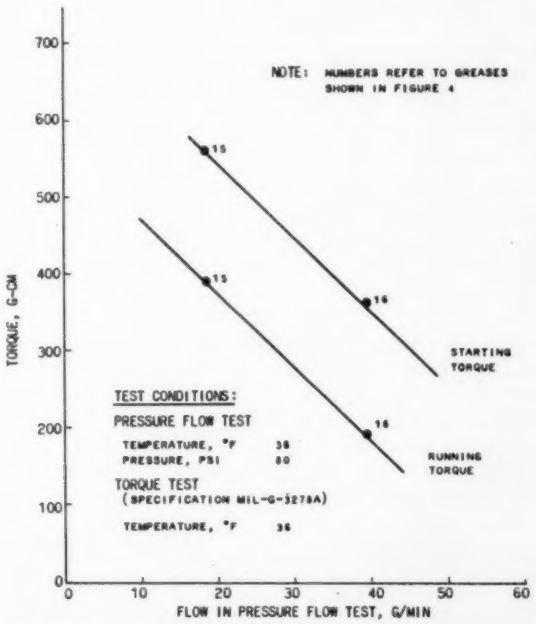

FIGURE 9—Typical chart relating pressure flow test data with bearing torque.

The latter term C can be determined quickly by measuring the flow rate of the grease in the pressure flow test at one pressure and temperature. Flow rates can then be calculated for a range of shear rates and temperatures with the accuracy generally required for engineering studies.

Conclusion

The pressure flow test has proved to be a valuable test for predicting the flow properties of greases in our research and development programs. The flow rates obtained from this test correlate well with those of various types of commercial grease dispensing equipment. The repeatability of the test results is good, and the data can be used for determining apparent viscosity at various shear rates. The apparent viscosity data can be used in charts for predicting pumpability of greases, similar to those developed by Mr. W. L. Gabbert of Lincoln Engineering Co.[3] The data are also applicable for determining constants for use in empirical formulas for determining flow of greases under various conditions.

Bibliography

1. "Grease Pumpability at Low Shear Rates" by J. Simson and E. L. Armstrong, ASLE Annual Meeting, Buffalo, N. Y. (April, 1959)
2. Criddle, D. W., NLGI Spokesman, *22*, No. 8, 381 (1958)
3. Gabbert, W. L., NLGI Spokesman, *24*, No. 2, 55 (1960) ■

Selling the Lubricating Grease Market

By: C. L. Johnson
Jesco Lubricants Co.

Presented at the NLGI 28th annual meeting in Chicago, October, 1960

AMERICAN business lulled into a state of complacency during the early post-war period, and ended to forget the time-proved truth that the "Consumer is King." When production of consumer goods began to slacken, businessmen ordered their sales staffs to "get out and sell." This is a healthy attitude for it cannot be disputed that selling is half the marketing battle.

However, the phrase conjures up the image of the inspired "high-pressure salesman" persuading the overpowered consumer to buy something he never knew he wanted. What is needed is a more comprehensive approach than mere "high-pressure salesmanship," and it is the task of marketing expansion to give the necessary insights into a complex picture.

At the present stage of development of marketing knowledge, it seems that a definitely theoretical approach would be more appropriate for advanced study wherein one gives specialized attention to but one aspect of marketing. The field of marketing is, however, so vast and is composed of such a large number of complex and varied elements that the development of a body of generalizations so inclusive as to be properly described as "the theory of marketing," appears highly improbable. Instead of one theory it appears more likely that marketing, when more fully developed, will consist of numerous complementary theories of limited scope built upon the formulation of additional principles, just as there is an economic theory of a number of theories. Attention to the theoretical aspects of marketing by leading thinkers in the field is, therefore, highly desirable, because it raises important questions which point the way to further investigation of debatable issues. This gives direction to the application of scientific inquiry in areas of marketing hitherto inadequately explored in an objective manner through basic research, and it should contribute to the future development of a more complete and integrated body of marketing knowledge.

First, there is the problem of finding out what the purchaser wants. This involves not only detecting preferences among existing products and services, but also discovering wants that only new or improved products and services will adequately satisfy. While manufacturers and distributors can do much to stimulate, modify and direct consumer demands, they can do little to make their commodities salable unless they are adapted to the needs of the consumer. Growing recognition of this principle has led those engaged in marketing to orient their thinking toward consumption.

Markets for consumer goods may be regarded as consisting of people who have needs and wants, and who have the buying power to express their wants in terms of effective demands for goods and services. Stimulating, altering and directing consumer demand is accomplished largely through advertising and personal salesmanship. Efforts to accomplish this may be altogether fruitless, very costly or relatively efficient, depending upon whether products actually have the characteristics or capacities to satisfy the wants of a responsive chord with a large segment of the consuming groups to which they are directed.

For efficient performance of the task, marketing organizations must understand the people that make up the population of the specific group that is to be the ultimate consumer of the products they have to offer. Consumers are very directly conscious of many of their wants, but it is also true that they are made aware of others as a result of marketing activity. Marketing stimulates, arouses, modifies or creates wants by making consumers aware or more conscious of their needs, and calls attention to specific products and services as the means of satisfying their needs. Actually, properly conceived selling efforts stem from the premise that wants arise out of needs.

Second, there is the task of informing the consumer of products that might better serve his needs. This task requires, among other things, a better informed sales organization that is fully aware of buying habits, buying motives, and likes and dislikes of the consumer market.

Third, it is necessary to increase efficiency and reduce cost of distribution. Unduly high costs and avoidable inconveniences in shopping must be eliminated.

To understand what marketing is, the term "marketing" must be clearly understood. The most common definition of marketing is "the process of getting goods or services out of the hands of the producer into the hands of the consumer." Wholesaling and retailing; buying, selling and advertising; collection and accounting; storage and delivery—all are but parts of the whole. A broad definition of marketing is essential if a sound understanding of marketing development in its many aspects is to be attained. Development of the American markets through marketing development requires not only the important contribution of ideas, but the application of historical and scientific principles of observation and experimentation.

It may be said that marketing includes everything that happens to merchandise between the time it leaves the floor or the machine of the producer, and the moment it comes to rest in the establishment of the user. It is also involved in a series of business activities usually not precisely defined, occurring prior to production and having to do with the planning of what and how much shall be produced.

To sum up, what is marketing development? Marketing development is the application of scientific principles to observational, experimentational, historical and survey methods in a careful search for more accurate knowledge of consumer and market behavior, so that more effective marketing and distribution may be developed.

There are three parties or groups of parties at interest in the marketing process—the manufacturer, the consumer and the several varieties of distributive agents who handle your type of merchandise in the course of its journey from producer to consumer.

The most significant party at interest in the marketing process is the consumer. He is the end and aim of it all. This is true whether we view the matter from the broad consumer standpoint or from that of the profit of the individual producer or distributor.

A consumer is one who uses an article or service—they are of two types. Those who use goods or services for the purpose of producing other goods or services, and those facilitating the operation of an enterprise as a business or an industry. It has been remarked that the consumer is king. It is undoubtedly true that the producer whose merchandise fits perfectly the needs or desires of the consumer, will find the path to profits much less thorny than he who seeks to induce the purchase of a product which is not so well adapted.

Decision making requires facts and data about the conditions and nature of the problem. Marketing development is the tool by which management is supplied the necessary information which imagination and ingenuity convert into a stronger competitive position.

Marketing development informs management where the company stands in its industry, and predicts and analyzes industry trends. It is an essential management tool in appraising and improving sales management effectiveness, and it aids management in the development and introduction of new products. Development may not only help management to increase sales, but also cut marketing expenses and foster a progressive spirit in management that may spread throughout the company.

With the guidance of development it is more probable that products will be suited to consumer demands, will be priced in accordance with demand, and will be offered to the specific markets that have the greatest sales potential. Development can increase sales by determining the best sales appeals of the product, the best ways to reach the potential buyers, the right timing of promotions, and the market areas in which the selling and advertising will bring the greatest return.

The functions by which marketing development provides guiding data to management are many. Some of the functions are classified into three main categories: Markets, products and distribution methods.

Markets

In studying markets the objective is to determine the sales potential of the product. To qualify and understand the nature of the market, marketing development does the following:

1. Analyzes markets as to consumer opinions and attitudes about available products, rates, habits of usage, purchase of the products and comparative standings of existing products. There are, of course, still regional variations in market demand. These differences are to a certain extent determined by the gradations in the buying power of the population in different territories, and by climatic conditions which effect the need for or suitability of a particular product.
2. Studies the relative conditions in the market as to prices, distribution set-ups and promotional methods. This endeavor may be divided into two great classes: services and salable goods. Services may be defined as "intangible or impersonal activities or anticipated satisfactions which are offered for sale, either as such or in connection with the sale of your product. In this category are included such diverse items as the activities of an engineer, service engineer, mechanic, sales engineer, etc.

   There are no reliable figures indicating the volume of services bought by consumers annually. Several authoritative estimates have been made, however, and the Department of Com-

merce estimates the totals to be in billions of dollars for recent years.

3. Estimates sales potential for the industry, company and its products and marketing areas.
4. Establishes sales territories so that the sales organization can maximize its personnel and efforts.
5. Establishes sales quotas by which to gauge salesmen's, distributors' and dealers' performances.

Products

One of marketing development's most valuable uses is in continually appraising new and old products and recommending how to adapt them to changing market conditions. In this regard marketing development conducts studies to:

1. Determine what improvements are needed in present products to gain use advantage.
2. Find new uses for old products to expand their market potential.
3. Find markets for new products including market prices, specifications and performance characteristics.
4. Determine the suitability and improvement of packaging. Packaging studies involve many phases—pricing, advertising and display value, size of unit purchases, ability to stand transportation and compliance with interstate regulations.
5. Simplify the product line.

Distribution Methods

The increasing complexity of marketing requires that management constantly survey its distribution methods and policies. To cope with the dynamic nature of market conditions, marketing development performs the following kinds of functions:

1. Studies the company's and competitor's price structures in the light of economic conditions and market characteristics.

   First, let us assume the simplest situation in which a new company brings out a new product and must fix an introductory price for it. Let us assume further that the product in question is a consumer product and not a raw material. In planning to make and sell a finished product, the manufacturer or producer is immediately confronted with two closely related questions of policy, "How good a product shall I make?" and "How much shall I charge for it?" Various formulas have been suggested by use of which an answer to one or both of these queries might be derived entirely from a study of the manufacturer's costs, but the solution to both problems is to be found primarily in the market, and only secondarily in the factory. For the market lays down a definite mandate as to both quality and price, even though much skill may be required to read that mandate aright in the riddle of consumer reaction in which it is hidden. There is apt to be constant conflict among the forces pulling in the several directions, in which the same product may vary. It may be said that while economic theory provides a first approach to the study of competition, the marketing manager needs to consider the whole question in terms of the individual enterprise which he is attempting to aid, in adjusting itself to competition and in making the most of its opportunities in doing so; but in making this approach it is not sufficient to consider the matter solely on the basis of the theory of monopoly or of uncontrolled competition. There are many other phases of the process of adjusting the individual establishment to competition besides that of price manipulation. Furthermore, the question which confronts the enterprise in the field of price policy alone, is commonly far more complicated that that of merely determining what the traffic will bear in terms of the usual theories of price.
2. Studies wholesale and retail margins.
3. Compiles performance standards for distributors and dealers.
4. Analyzes salesmen's performance as to sales, costs, profits and balances line selling. Examining the employment and performance records of his firm, the sales manager who has one or many salesmen, may evaluate the various sources of candidates for jobs in his organization. He may make a statistical analysis of the men employed who were obtained from each source, and of the cost of procuring them.

   The sales manager must develop machinery and methods by which to select from among the applicants for jobs, those who are best qualified to become members of his force. Three devices are most universally employed in this work. Practically all concerns require each candidate for a sales position to complete an application blank, on which he sets down a more-or-less detailed history of his past business career, together with numerous other facts about his training and experience, which are regarded as indicative of his fitness for the job. The sales executive analyzes these facts in the light of the characteristics for which he is seeking, and in this way evaluates the qualifications of the candidates.

   A second device which is almost invariably

used in the work of selecting salesmen is the interview. It is a particularly valuable tool for this purpose, because one very important part of the salesman's task is selling himself to prospective customers, and it affords the sales manager an opportunity to observe how well the candidate performs this vital part of the job for which he is being considered. Usually the interview is conducted informally, and the interviewer judges the applicant merely on the basis of the general impression he gains from talking to him. Many better managed concerns use the "jury" method; the candidate is interviewed by several persons in succession.

The recommendation is the third most generally used tool in selecting salesmen. The applicant's former employers or other persons with whom he has previously been associated are requested to furnish certain information about their contacts with and opinions of him. It is desirable to make the results obtained from the use of this device as specific as possible.

5. Analyzes sales statistics in regard to customer, territory and product requirements and profitability.
6. Appraises distributors' methods to determine most efficient channels and policies to employ.
7. Analyzes distribution costs to identify unprofitable segments of sales and to devise methods of converting losses into profits.

The planning and control of the transportation activities of the average firm are usually in the hands of its traffic manager. Among other things he routes both incoming and outgoing shipments or checks the routings proposed by customers or sources; checks freight bills; presents and endeavors to collect all claims which the company has against the carriers; furnishes rate and schedule information to the sales manager and purchasing agent; and keeps watch over the movement of shipments in order to make sure they arrive on time.

The nature and peculiarities of our transportation system exercise a profound influence upon the pattern of our marketing organism. The relation between L.C.L. and C.L. rates, for instance, may be the determining factor in the manufacturer's choice between wholesalers and his own distributors from warehouses, to his jobbers and dealers.

8. Studies customer relations to enhance institutional good will and product acceptance.
9. Evaluates advertising media to determine most efficient coverage of the market.

First, the advertiser must be certain that the product to be promoted actually satisfies some basic need; otherwise, no amount of advertising can win acceptance for the product. Second, it is necesary to discover the uses or applications of the product, and confine the advertised uses to reasonable ones that satisfy important common needs. Third is the determination of distinctive characteristics of the product to be used as selling appeals. For advertising to be successful over a period of time, these should be real and recognizable distinctions. Most manufacturers' advertising is characterized by an attempt to give the product a personality or identity which will make it stand out competitively. This requires close coordination between the planning of advertising and the package or label design.

Other major management problems relate to the determination of the market for the product, whether general or highly restricted to a segment of the total market; the selection of media which will reach the consumers of the product and possibly the trade; and the determination of an advertising appropriation that will be adequate to accomplish the objective of the program.

10. Studies competitors' advertising, sales promotion, and sales methods in order to develop market advantages.
11. Determines the effectiveness of company's advertising—is the advertising providing the expected results? Is it influencing the minds, emotions and actions of prospective buyers toward the purchase of your company's products? ■

About the Author

C. L. JOHNSON *received a BS degree from the University of Oklahoma in* 1917. *He began his business career with Marland Refining Co., Ponca City, Okla. In* 1929 *he became associated with Jesco Lubricants Co., North Kansas City, Mo., of which he is now president. Elected vice-president of NLGI at the recent annual meeting, Mr. Johnson has served on the Institute's board of directors since* 1953. *A member of ASTM, ASLE, SAE and API, he has been a previous contributor to the* SPOKESMAN.

Future Meetings

FEBRUARY, 1961

5-10 ASTM Committee D-2 meeting, Benjamin Franklin Hotel, Philadelphia, Pa.

15 NLGI Board of Directors meeting, O'Hare Inn, Des Plaines, Ill.

16-17 Lubrication Committee of API, O'Hare Inn, Des Plaines, Ill.

APRIL, 1961

11-13 American Society of Lubrication Engineers Annual Meeting and Exhibit, Bellevue-Stratford Hotel, Philadelphia.

19-20 National Petroleum Association, Semiannual Meeting, Sheraton-Cleveland Hotel, Cleveland.

MAY, 1961

8-9 ASME Lubrication Symposium, Deauville Hotel, Miami Beach, Fla.

13 NLGI Board of Directors meeting, Hollywood Beach Hotel, Hollywood Beach, Fla.

15-16 Lubrication Committee of API, Hollywood Beach Hotel, Hollywood Beach, Fla.

16-19 API Division of Marketing, Midyear Meeting, Americana Hotel, Miami Beach.

JUNE, 1961

11-15 ASME Summer Annual Meeting, Statler Hilton Hotel, Los Angeles.

24-29 ASTM Committee D-2 meeting, headquarters undecided, Atlantic City, N. J.

SEPTEMBER, 1961

11 NLGI Board of Directors meeting, Roosevelt Hotel, New York City.

13-15 National Petroleum Association, Annual Meeting, Traymore Hotel, Atlantic City.

OCTOBER, 1961

17-19 ASME-ASLE Lubrication Conference, Hotel Morrison, Chicago.

OCT. 29 - NOV. 1, 1961 NLGI Annual Meeting, Rice Hotel, Houston, Tex.

NOVEMBER, 1961

9-10 SAE National Fuels and Lubricants Meeting, headquarters undecided, Houston, Tex.

13-15 American Petroleum Institute Annual Meeting, headquarters undecided, Chicago.

26-Dec. 1 ASME Winter Annual Meeting, Statler Hilton Hotel, New York.

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Literature and Patent Abstracts

Composition

Diesel Engine Lubricants

Semi-fluid lubricants in which finely-divided basic substances are suspended are recommended for lubrication of marine diesel engine cylinders in order to reduce cylinder wear. This suggestion occurs in British Patent 840,312 issued to The British Petroleum Co., Ltd., Pethrick and Morrison. The basic solids found suitable include calcium carbonate, calcium hydroxide, magnesium hydroxide, basic magnesium carbonate and magnesium oxide. These should be of such fineness that at least one dimension of the particles is less than one micron. While aluminum and lithium stearates are mentioned as suspending agents, most of the examples use a calcium soap for the purpose.

Thus, a mixture was made of 89.62 per cent of an SAE 30 oil, 6.37 per cent of a calcium base lubricating grease containing 23 per cent soap and 4 per cent of calcium carbonate passing a 200 mesh sieve. The grease was mixed with most of the oil and a slurry of the calcium carbonate in the rest of the oil was added. Finally, the mixture was homogenized and deaered before use. The lubricant should have a yield value at 25°C between 5 and 40 dynes per cm.^{2} and yet it should pour from a container.

When tested in a single cylinder diesel engine, the above composition gave less wear than did the base oil when used as lubricants. This was in a case where a residual fuel was used.

Soaps of Alpha Sulfo-Fatty Acids as Thickeners for Lubricating Grease

According to Nelson in U. S. Patent 2,951,809 (assigned to Sinclair Refining Co.) lubricating greases with high dropping points can be made if the thickener consists of metal soaps of alpha-sulfo-fatty acids. Desirable fatty acids are those having twelve to twenty-two carbon atoms per molecule and a $-SO_3H$ radical attached to the alpha carbon atom. The preferred soaps are those of calcium or lithium.

For example, in making a lithium base product, 198 grams of alpha-sulfo stearic acid were dispersed in 600 grams of a conventionally refined naphthenic oil, having a vis-

cosity of 750 SUS at 100° F. To this were added 51 grams of lithium hydroxide monohydrate dissolved in 250 grams of boiling water. After saponification was complete, the temperature was raised to 338°F. during dehydration. One per cent of Age-Rite Resin D was added as an oxidation inhibitor and the mass was cooled to 200°F. before milling at .005-inch clearance. This gave a lubricant with 385 worked penetration and 500+ dropping point.

A lubricating grease made with a similar calcium base soap had an unworked penetration of 306, worked penetration of 352 and dropping point of 374°F.

Antioxidants for Lubricating Greases

Norton and Pattenden (see U. S. Patent 2,951,808, assigned to Esso Research and Engineering Co.) have found that 0.1 to 15 weight per cent of alkali metal salts of aromatic hydroxy carboxylic acids act as antioxidants in lubricating greases. The most desirable salts are mono- or dilithium or sodium benzoates or salicylates. It is desirable that the same metal be present in the salt as that used in the soap thickener.

Dilithium salicylate was prepared by dispersing one mole of powdered salicylic acid in water and adding 2 moles of lithium hydroxide after which the mass was heated to dehydrate. The resulting salt was dissolved in a 50/50 mixture of ethanol and water and recrystallized. Alternately, the salt may be formed by neutralizing the aromatic acid in conjunction with the formation of the soap thickener.

A lubricating grease consisting of 88 per cent of an oil of 200 SUS at 100°F. and 12 per cent of a lithium-calcium soap of 12-hydroxy stearic acid (lithium 20 parts to 80 of calcium) was tested before and after being inhibited. The manner of test was to smear 10 grams of the lubricant on a watch glass and place in an oven maintained at 300°F. observing the appearance at varying time intervals. The untreated sample was black and fluid after 70 hours whereas the portion containing 1 per cent of monolithium salicylate

was tan and one containing 1 per cent of dilithium salicylate was light tan. After being exposed to carbon dioxide and then in the oven the base grease was brown after 24 hours whereas the sample containing the di-lithium salt was white to light tan.

Lithium Soaps of Styrenated Fatty Acids As Grease Thickeners

Lubricating greases of improved shear stability are formed if the thickener consists in whole or in part of lithium soap of styrenated oleic acid. Such products are described by O'Neil in U. S. Patent 2,953,528, assigned to Texaco Inc.

Styrenated oleic acid was formed by mixing 1000 grams of oleic acid and 1000 grams of styrene and heating under reflux at 150°C. for ten hours followed by an additional sixteen hours at 150 to 260°C. The product was then cooled quickly by drawing in thin layers to give a hard brittle solid having a neutralization number of 84.

The Literature and Patent Abstracts column is written for NLGI by C. J. Boner, chief research chemist for Battenfeld Grease and Oil of Kansas City, Missouri.

A lubricating grease containing 16.5 per cent soap was prepared by charging 290 grams of the above styrenated oleic acid, 300 grams of a naphthene base oil having a viscosity of 312 SUS at 100°F., and 138 grams of 10 per cent aqueous solution of lithium hydroxide. This mixture was heated for one hour at 200°F. to effect saponification and then for an additional hour at 300° F. to dehydrate. An additional 300 grams of oil were added while the temperature was maintained at 300° F. and 904 grams more oil while the mass was cooled from 300 to 220°F. After adding phenyl alpha naphthylamine as an oxidation inhibitor, the mass was given two passes through a Premier Colloid Mill at 0.002-inch clearance.

The finished product had a worked penetration of 271 which changed to 313 after 100,000 strokes in a grease worker. The dropping point of this tan slightly stringy lubricant was 381°F. A similar product containing 9.7 per cent each of lithium stearate and of the lithium soap of styrenated oleic acid had a dropping point of 371, and a worked penetration of 275, changing to 328 after 100,000 strokes.

Lubricating Grease for Small Mechanisms

McKibben and Lipton in U. S. Patent 2,953,527, assigned to the National Cash Register Co., describe a lubricant for intricate mechanisms having a large number of bearing surfaces. The preferred composition consists of 78 per cent of an oil having a viscosity of 150 SUS at 100°F., 18 per cent of the non-straight chain fractions of micro-crystalline petroleum wax, and 4 per cent of aluminum stearate.

Desirable wax fractions are obtained by first dissolving 10 parts by weight of a micro-crystalline wax in 90 parts of xylol. Next, 40 parts of finely-divided urea crystals are mixed with the above solution, keeping the temperature at a point where the wax remains in solution but below the melting point of the urea. Then, two to five parts of water are added to the mixture. Under these conditions the urea combines with the straight-chain components of the wax forming a crystalline powder, while the non-straight chain fractions of the original wax remain as an xylol solution. The desirable material is then separated by filtration and evaporation of the solvent.

The resulting lubricating grease will not pour until it reaches a temperature of about 180°F. and yet will maintain its lubricating char-

acteristics at 0°F. If it is desired to have a fluid lubricant which can be sprayed or applied by dipping or from an oil can, the lubricating grease is dissolved in an equal amount of petroleum distillate having a boiling range of 300 to 400°F.

Processing

Method for Measuring the Degree Of Uniformity of Mixing

Black and Forster in U. S. Patent 2,936,377, assigned to Esso Research and Engineering Co., find that iodine 132, added to lubricating fluids or greases, can be used as an aid in determining the uniformity of mixing. Iodine 132 is a radioactive isotope of iodine which has a half life of only 2.33 hours and consequently the radiation due to this element will substantially disappear within a few hours. Fresh iodine 132 can be prepared as required by dissolving tellurium dioxide in aqueous sodium hydroxide followed by precipitation of the tellurium dioxide with acetic acid to leave iodine 132 in solution.

In carrying out the suggested measurements, sufficient iodine 132 is added to the mixture to provide one to twenty microcuries per pound of the composition. Following this, a stream of the mixed composition is continuously monitored with a radiation rate counter during the mixing operation. The amount of fluctuation in the radioactivity detected measures the non-uniformity of the mixture. Alternatively, a sample can be removed from the mixer and the activity of this sample compared with a standard.

Method of Preparing Solid-Thickened Lubricating Greases

In U.S. Patent 2,948,679, Rees and Kemp (assigned to Texaco Development Corp.) describe a method and apparatus whereby solids are continuously compounded with lubricating oil, with or without the inclusion of soap, to form lubricating greases. The particular feature of the process is that a mixture of the solid particles and either oil or water are led through a tubular

zone at high velocity while the fluid is vaporized. Here the solid particles impinge against one another and the tube walls and are converted to finer particles. A further aid in this respect is discharge through a nozzle.

Suggested solids include silica, alumina, magnesia, calcium hydroxide, magnesium hydroxide, iron oxide and hydroxide, vanadium oxide, silicates of magnesium, calcium, and aluminum, calcium sulfate, calcium carbonate, calcium phosphate, clay, or carbon which may take the form of graphite.

For example, 23.69 parts of silica gel particles, two to four mesh in diameter, were mixed with 76.31 parts of water and the slurry passed at the rate of 1109 pounds per hour through ½-inch tubular heating coils wherein the water was heated to 754°F and vaporized to form a dispersion flowing at a velocity in excess of 2000 feet per second. After passing into a separator where steam was removed, silica particles between .005 and 7 microns in diameter were recovered. These particles were mixed with an oil of 300 SUS at 100°F and heated to 250°F to give a lubricating grease containing 15 per cent silica.

Process

Lubricating Grease Manufacture Which Includes Mechanical Atomization

In two U.S. Patents, namely 2,950,248 and 2,950,249 assigned to Socony Mobil Oil Co., Inc., Armstrong, Butcosk and Murray in the one case and Armstrong, Marshall, Murray and Raich in the other case, describe lubricating grease manufacture in which spray atomization of the thickener-oil mixture is used. The first process provides for atomization of either an anhydrous or dry soap-oil mixture at a temperature below the solution temperature of the soap in the oil but above 212°F. The dispersed droplets are immediately contacted with a cooler atmosphere so that heat exchange takes place. In this step, provided the initial soap-oil mixture is wet, dehydration of the mass may also take place.

The second process provides for atomization of a wet soap-oil mixture at a temperature above 250°F but below the solution temperature. In this step the droplets are substantially dehydrated. Next, the mass is subjected to a more intense mechanical atomization at a temperature above 220°F but below the solution temperature. Such a two-step atomization process is said to provide not only a rapid method of manufacture but also improve the yield obtained.

Where a single atomization is used, examples of the preparation of lithium-calcium, sodium-calcium, calcium tallow-calcium acetate, sodium, lithium hydroxy stearate and lithium-calcium stearate-wool grease thickened lubricating greases are given. Soap formation took place in a Stratco Contactor from which the mass was discharged through nozzles at 700 to 4,000 psi. The temperature at the time of discharge was 330°F in the case of a satisfactory finished lubricant which had penetrations of 307 after 60 strokes and 338 after 50,000 strokes, the latter with a worker plate having 1/16 inch holes. In contrast, the same formulation having 6.76 per cent soap in each case had respective penetrations of 390 to 400.

When two-stage atomization is used, the examples given are for the preparation of either lithium-calcium or lithium base lubricating greases. The processing conditions are varied to indicate their influence on the shear stability and yield of the finished lubricating grease. Thus, a product in which the total ingredients consisted of 1.4 per cent hydrogenated soya fatty acids, 5.4 per cent hydrogenated castor oil acids, 1.1 per cent lithium hydroxide monohydrate, 0.2 per cent anti-oxidant and 91.9 per cent naphthenic oil of 750 SUS at 100°F was made as follows. The soap-forming ingredients and 37 per cent of the

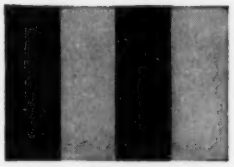
oil were heated in a Stratco Contactor to 360°F over a period of 1¼ hours. This mixture was atomized through a nozzle having an orifice diameter of 0.29 inch into a kettle. The charge had a water content of 2.1 per cent before discharge and 0.20 per cent afterward. The remainder of the oil was added at 300°F and the resulting product was then atomized through a nozzle having an orifice diameter of 0.051 inch and a core with four grooves each 0.020 by 0.035 inch in cross-section. The pressure at this nozzle was 900-1200 psi. After being cooled and deaerated, the product had a worked penetration of 252 which changed to 326 after 60,000 strokes using 1/16 hole worker plate. Additives may be introduced at any stage desired.

Application

The Lubrication of Bearings at High Temperatures

E. G. Ellis, *Scientific Lubrication* (London) v. 12, No. 9, Sept. 1960, pp 16-18, 20-23, states that many different types of lubricants have been tried for lubrication at high temperatures and in the listing are lubricating greases.

However, in elaborating on the subject, no examples are given of the use of or trials of lubricating greases.



People in the Industry

Named Director of New Gulf Division

Joel H. Hirsch, formerly chief development engineer at Gulf Research & Development company, Harmarville, Pa., has been appointed director of the laboratory's newly-formed Development Engineering division.

The new division combines the former functions of the Laboratory's Computational Analysis and Development Engineering sections. A third engineering section, composed of chemical and mechanical engineers formerly in the Process Design division of the Manufacturing department of Gulf Oil corporation, also has been added to this division.

Southwest Promotes Borden and Hodges

H. A. Mayor, Jr., executive vice-president of Southwest Grease & Oil Co., Inc., recently announced the promotions of John C. Borden to the position of sales manager; and Jack R. Hodges to manager, technical service.

John Borden graduated from the University of Southern California and just recently completed six years with the American Flange & Manufacturing Co., as a midwest and southwest district sales representative, before joining Southwest Grease. Mr. Borden's wide and diversified experience in the packaging industry has proven very valuable to many Southwest customers. Mr. Mayor announced that under John Borden's direction, the sales staff will undergo some minor territory changes which will provide more complete and personalized service to all Southwest customers.

Jack Hodges' promotion to manager, technical service, is a milestone in the progress of Southwest Grease. For many years, Southwest has contemplated providing this technical service expert for their customers. Mr. Hodges has had approximately twelve years of technical experience in the lubrication field since graduating from Kansas State university. He is an active

member of SAE and ASLE, plus other technical lubricating societies. Both men will assume their new respective assignments immediately.

Mr. Mayor concluded by mentioning the home office of Southwest Grease & Oil Co., Inc., in Wichita, had just completed a $250,000 expansion program during the 1960 year. This included a new office building, a large new warehouse and extensive additions to plant equipment and facilities.

Brunstrum Named Senior Research Associate

The appointment of Lawrence C. Brunstrum as senior research associate in the research and development department at Whiting, Ind., has been announced by American Oil company.

In his new position Mr. Brunstrum will lead research on the rheology of such petroleum products as oils, greases and asphalts. Such studies of the flow behavior of materials have been intensively pursued in recent years. In petroleum research, for example, knowing the way in which liquids and solids flow aids scientists in determining how well a grease will lubricate, how a motor oil will act in a cold engine, and whether an asphalt will make a good roof or road. Dr. Arthur W. Sisko, senior project chemist, will be associated with Mr. Brunstrum in this research.

Mr. Brunstrum joined the laboratory staff in 1929, after graduating in chemical engineering from Armour Institute of Technology. He has become well-known as a leader in research on lubricants through his many published articles and patents. His most recent position was that of section leader in charge of research on greases and industrial lubricants. He has carried out and directed pioneering basic research that has resulted in major contributions to a better understanding of the nature and properties of lubricants. Among the new and unusual oils and greases developed under his direction were several designed to meet the severe requirements of military vehicles and aircraft.

The many scientific and technical societies in which Mr. Brunstrum has been active include the American Chemical Society, the American Society of Lubrication Engineers, the American Society for Testing Materials and the National Lubricating Grease Institute. Besides having served on several committees of these societies, he is now chairman of the general technical committee of NLGI. In 1958 he received the Institute's Award for Achievement.

Joins Dixon as Sales Representative

Spencer Chase has joined the Joseph Dixon Crucible company, Jersey City, N. J., as sales representative in the Chicago-Milwaukee areas, according to Ralph Rathyen, industrial sales manager.

Mr. Chase comes to the organization with ten years of varied industrial sales experience. He will represent both the paint and lubricants division of Dixon.

Harchem Adds Two to Staff

The Harchem division of Wallace & Tiernan Inc. announces the appointment of Peter J. O'Reilly to its product development department. Mr. O'Reilly was formerly with Roger Williams Technical and Economic Services.

Announcement is also made that Donald Wild, formerly with Chemical Rubber Co., has joined Harchem's field sales staff and has been assigned to the Midwest area.

Bulletin Describes Lincoln Lever Guns

Lincoln Engineering Co., 4010 Goodfellow Blvd., St. Louis 20, Mo., has announced the availability of Bulletin 732 illustrating and describing the company's 1142 and 1169 economy model lever guns. Identical except for the follower setting, both guns feature three-way reloading (cartridge, from filler pump or by suction) and high-pressure operation (up to 10,000 psi grease pressure).

Model 1169 is set to handle lube cartridges, while Model 1142 is set to dispense bulk grease. However, by merely flipping the follower to the correct position, either gun is capable of handling cartridges or bulk grease.

Industry News

New ASTM Compilation of Standards on Petroleum Products and Lubricants

The 1960 edition of the ASTM Compilation of Standards on Petroleum Products and Lubricants contains 168 standards of which some 31 are new, revised, or have had their status recently changed. The standards have been prepared by ASTM Committee D-2 on Petroleum Products and Lubricants. The compilation is being published in two volumes for the first time.

Volume I will contain most of the ASTM standards on petroleum including crude petroleum, butadiene, motor and aviation fuels, naphthas, diesel fuels, lubricating oils, industrial oils, cutting oils, turbine oils, greases, waxes, spray oils, and other related materials.

Petroleum chemists and technologists, engineers, and purchasing agents will find this compact volume handy in their daily work.

This is the 37th annual edition of the compilation which includes methods of testing, specifications, definitions, charts and tables. The volume contains eleven extensive appendices containing proposed methods. Typical of some of the new standards included in the book are: Water and Sediment in Fuel Oils by Centrifuge; Luminometer Numbers of Aviation Turbine Fuels; Refractive Index of Viscous Materials; and Oil Separation from Lubricating Grease During Storage.

The exact size of Volume II has not been established, nor can a publication date be set, other than it is hoped that it will be available during the early months of 1961. It will include a number of standards prepared by other ASTM Committees which are related to those in Volume I and used in the petroleum industry. The following list shows the general subjects covered by the standards in Volume II and the related Committees: solvents (D-1), gaseous fuels (D-3), bituminous road and paving materials (D-4), waterproofing and roofing materials (D-8), electrical insulating oils (D-27), industrial aromatic hydrocarbons (D-16), wax polishes (D-21), general methods of test (E-1), nomenclature and definitions (E-8), quality control (E-11), and absorption spectrometry (E-13).

Copies of this book may be obtained from ASTM Headquarters, 1916 Race St., Philadelphia 3, Pa. at $9.50 each.

Bennett to Open Pail Manufacturing Plant

Stevens A. Bennett, who had a part in designing and manufacturing the first five-gallon steel pails for the paint industry in 1914 and who is now chairman of Bennett Industries, Inc., Peotone, Ill., has announced the opening of a pail manufacturing plant in Alta Loma, Calif., in the near future. The present buildings on the 120,000 sq. ft. site will house the most modern steel pail fabricating equipment to manufacture containers from three gallons to seven gallons. The latest hi-bake lining installation will assure proper application of the correct lining for each product.

Anthony J. Gasbarra, president of Bennett Industries, expects to have the new manufacturing unit in operation within a few months, but in the meantime, greater stocks of containers have been diverted to the West Coast warehouses to take care of the increased demand.

Steel pails will be the only product of the Alta Loma plant, according to present plans. The Peotone container plant will continue to manufacture all types of steel pails, steel drums and fibre drums as in the past. The Structural division will continue to fabricate heavy steel and plate for the chemical, mining and petroleum industries in Peotone.

Fafnir to Celebrate 50th Anniversary

President Clarence G. Rosensweig of the Fafnir Bearing Co. has issued a statement noting that the company will reach its 50th birthday in March and announcing plans for a golden anniversary program.

The statement cited Fafnir's founding in 1911 under very modest circumstances and subsequent growth to a position of leadership in a vital industry. It also disclosed that the company plans appropriate recognition of its 50-year milestone through a program of special activities. This program will be high-

NLGI Associate, Technical

CONTAINER AND CLOSURE MANUFACTURERS

American Can Company
4810 Belleview, Kansas City 12, Mo.
Representative—H. T. Rich

American Flange & Manufacturing Company, Inc.
30 Rockefeller Plaza, New York 20, N. Y.
Representative—Richard L. Parish, Jr.

Bennett Industries
Peotone, Illinois
Representative—S. A. Bennett

Central Can Company, Inc.
3200 South Kilbourn Ave., Chicago 23, Ill.
Representative—Henry Frazin

Cleveland Container Company
4919 So. Halstead St., Chicago 9, Ill.
Representative—R. D. Sayles

Continental Can Company, Inc.
100 East 42nd St., New York 17, N. Y.
Representative—W. J. Flint

Geuder, Paeschke & Frey Company
324 North Fifteenth St., Milwaukee 1, Wis.
Representative—Neil Savee

Greif Brothers Cooperage Corp.
1821 University Ave., St. Paul 4, Minn.
Representative—Ray Suttle

Inland Steel Container Company
6532 South Menard Ave., Chicago 38, Ill.
Representative—J. Daniel Ray

Jones & Laughlin Steel Corporation
Container Division
3 Gateway Center, Pittsburgh 30, Pa.
Representative—J. E. Morris

National Steel Container Corp.
6700 South LeClaire Ave., Chicago 38, Ill.
Representative—Henry Rudy

The Ohio Corrugating Company
917 Roanoke Ave. S. E., Warren, Ohio
Representative—Lawrence F. McKay

Republic Steel Corporation
Container Division
465 Walnut Street, Niles, Ohio
Representative—Theodore Humphrey

Rheem Manufacturing Company
400 Park Ave., New York 22, N. Y.
Representative—G. Gwyn Tucker

Rieke Metal Products Corporation
Auburn, Indiana
Representative—Raymond F. Ouer

Sefton Fibre Can Company
Div. Container Corp. of America
3275 Big Bend Blvd., St. Louis, Mo.
Representative—W. V. Swofford

Southline Metal Products Company
3777 West 12th Street, Houston 24, Tex.
Representative—Warren F. Wackman

Steel Package Division of National Lead Company
722 Chestnut Street, St. Louis 1, Mo.
Representative—Warren T. Trask

United States Steel Products
Division, United States Steel Corporation
30 Rockefeller Plaza, New York 20, N. Y.
Representative—C. R. Justice

Vulcan-Associated Container Companies, Inc.
P. O. Box 161, Bellwood, Ill.
Representative—V. I. McCarthy, Jr.

ENGINEERING SERVICES

The C. W. Nofsinger Company
307 East 63rd Street, Kansas City 13, Mo.
Representative—C. W. Nofsinger

Sumner Sollitt Co.
307 N. Michigan Ave., Chicago 1, Ill.
Representative—A. J. Barth

MANUFACTURERS OF EQUIPMENT FOR APPLICATION OF LUBRICATING GREASES

Balcrank, Inc.
Disney near Marburg, Cincinnati 9, Ohio
Representative—Richard P. Field

The Farval Division Eaton Manufacturing Co.
3249 East 80th St., Cleveland, Ohio
Representative—E. J. Gesdorf

Gray Company, Inc.
60 Northeast 11th Ave., Minneapolis 13, Minn.
Representative—B. A. Beaver

Lincoln Engineering Division McNeil Machine & Engineering Co.
4010 Goodfellow Ave., St. Louis 20, Mo.
Representative—R. E. Crean

Stewart-Warner Corporation
Alemite Division
1826 Diversey Parkway, Chicago 14, Ill.
Representative—E. G. Wicklatz

MARKETING ORGANIZATIONS

Ampol Petroleum, Ltd.
Buchanan Street
Balmain, New South Wales, Australia
Representative—M. E. Brownell

California-Texas Oil Company
380 Madison Ave., New York 17, N. Y.
Representative—Hal U. Fisher

Canadian Petrofina Limited
505 Dorchester Street West
Montreal, Quebec, Canada
Representative—M. E. Wight

Cooperative GLF Exchange, Inc.
Terrace Hill, Ithaca, N. Y.
Representative—W. S. Miller

Denco Petroleum Company
5115 Denison Avenue, Cleveland 2, Ohio
Representative—I. L. Carmichael

Derby Refining Co.
420 West Douglas, Wichita, Kan.
Representative—W. B. Neil

D-X Sunray Oil Company
Mid-Continent Bldg., P. O. Box 381, Tulsa, Okla.
Representative—J. W. Basore

Farmer's Union Central Exch., Inc.
P. O. Box G, St. Paul 1, Minn.
Representative—H. F. Wagner

Illinois Farm Supply Company
P. O. Box 585, Bloomington, Ill.
Representative—S. F. Graham

Lubrication Engineers, Inc.
P. O. Box 7128, Fort Worth 11, Texas
Representative—James P. Bell

M.F.A. Oil Company
P. O. Box 510, Columbia, Mo.
Representative—Stuart L. Spradling

Pennsylvania Refining Company
2686 Lisbon Road, Cleveland 4, Ohio
Representative—Ben Sollitto

United Co-Operatives, Inc.
111 Glamorgan, Alliance, Ohio
Representative—A. J. Miller

Valvoline Oil Company
Division of Ashland Oil & Refining Co.
Box G, Freedom, Penna.
Representative—R. L. Sailer

SUPPLIERS OF EQUIPMENT FOR MANUFACTURING LUBRICATING GREASES

Barrett Manufacturing Company
P. O. Box 8096, Houston 4, Texas
Representative—George J. Barrett, Jr.

and Marketing Members

Chemicolloid Laboratories, Inc.
55 Herricks Road, Garden City Park, N. Y.
Representative—David F. O'Keefe

Girdler Process Equipment Division, Chemetron Corp.
2820 West Broadway, Louisville, Ky.
Representative—J. E. Slaughter, Jr.

Stratford Engineering Corporation
612 W. 47th Street, Kansas City 12, Mo.
Representative—D. H. Putney

Struthers Wells Corp.
1003 Pennsylvania Ave. West, Warren, Pa.
Representative—K. G. Timm

SUPPLIERS OF MATERIALS FOR MANUFACTURING LUBRICATING GREASES

American Potash & Chemical Corp.
99 Park Avenue, New York 16, N. Y.
Representative—W. F. O'Brien

Archer-Daniels-Midland Company
Industrial Chemicals Division
P. O. Box 532, Minneapolis 40, Minn.
Representative—J. H. Kane

The Baker Castor Oil Company
40 Avenue A, Bayonne, N. J.
Representative—J. W. Hayes

Baroid Chemicals, Inc.
A subsidiary of National Lead Company
1809 South Coast Life Building
Houston 2, Texas
Representative—C. M. Finlayson

Cabot Corporation
141 W. Jackson Blvd., Chicago, Ill.
Representative—Warren M. Parsons

Climax Molybdenum Company
1270 Avenue of the Americas, New York 20, N. Y.
Representative—K. B. Wood, Jr.

Darling & Company
4201 South Ashland Ave., Chicago 9, Ill.
Representative—L. Strauf

E. I. du Pont de Nemours & Company, Inc.
Wilmington 98, Delaware
Representative—Joseph J. Mikita

The Elco Lubricant Corporation
Jennings Road & Denison Avenue
Cleveland 9, Ohio
Representative—R. K. Smith

Emery Industries, Inc.
4300 Carew Tower, Cincinnati 2, Ohio
Representative—David R. Eagleson

Enjay Chemical Company
Div., Humble Oil & Refining Co.
15 West 51st St., New York 19, N. Y.
Representative—Warren C. Wilson

Foote Mineral Company
18 W. Chelten Ave., Philadelphia 44, Penna.
Representative—W. M. Raynor

A. Gross and Company
295 Madison Avenue, New York 17, N. Y.
Representative—Eugene W. Adams

Harchem Division Wallace & Tiernan, Inc.
25 Main St., Belleville, N. J.
Representative—H. M. Abbott

Humko—Chemical Department
P. O. Box 398, Memphis 7, Tenn.
Representative—W. J. O'Connell

Kolker Chemical Corporation
600 Doremus Ave., Newark 5, N. J.
Representative—Lee H. Smith

Lithium Corporation of America, Inc.
500 Fifth Ave., New York 36, N. Y.
Representative—Malcolm M. Moore

The Lubrizol Corporation
Box 3057—Euclid Station, Cleveland 17, Ohio
Representative—J. B. Irwin

Mallinckrodt Chemical Works
2nd & Mallinckrodt Sts., St. Louis 7, Mo.
Representative—D. B. Batchelor

The McGean Chemical Co.
Midland Building, 101 Prospect Ave., N. W.
Cleveland 15, Ohio
Representative—W. A. Ritchie

Metasap Chemical Division Nopco Chemical Company
60 Park Place, Newark, N. J.
Representative—T. J. Campbell

Monsanto Chemical Company
800 North Lindbergh Blvd., St. Louis 66, Mo.
Representative—J. W. Newcombe

Newridge Chemical Company
7025 West 66th Place, Chicago 38, Ill.
Representative—T. E. Shine

M. W. Parsons—Plymouth, Inc.
59 Beekman St., New York City 38, N. Y.
Representative—Herbert Bye

Werner G. Smith, Inc.
1730 Train Avenue, Cleveland 13, Ohio
Representative—W. Meckes, Jr.

Swift & Company
165th & Indianapolis Blvd., Hammond, Ind.
Representative—F. H. Beneker

Synthetic Products Company
1636 Wayside Rd., Cleveland 12, Ohio
Representative—Garry B. Curtiss

TECHNICAL AND RESEARCH ORGANIZATIONS

Battelle Memorial Institute
505 King Avenue, Columbus 1, Ohio
Representative—S. L. Cosgrove

The Chek-Chart Corporation
33 East Congress Parkway, Chicago 5, Ill.
Representative—H. Eldridge

Chemico (Pty.) Ltd.
Miller and 7th Streets, P. O. Box 6349,
New Doornfontein, Johannesburg,
South Africa
Representative—O. Richter

Compagnie Francaise de Raffinage Direction Recherches et Procedes
22, Rue Boileau, Paris (16e) France
Representative—Albert E. Miller

Institut Francais du Petrole
CMR—Courtel, 4 Place Bir Hackeim
Rueil—Malmaison (S. et Oise) France

LABOFINA S. A.
Centre de Recherches du Groupe PETROFINA
Bruxelles 12, Belgium
Representative—R. Gillerot

Phoenix Chemical Laboratory, Inc.
3953 Shakespeare Ave., Chicago 47, Ill.
Representative—Mrs. G. A. Krawetz

lighted by an open house at its expanded Newington plant in the spring.

Bardahl Offers Two Booklets

Latest advancements in the lubricating oil field are explained through detailed charts, photos and text in an eighteen-page, three-color booklet, "New Dimensions." A four-pager shows the problem-solving application of "Polar-attraction" lubricants to high-speed machinery. Both publications are available. Request from Bardahl International corporation, 1400 West 52nd Street, Seattle 7, Wash.

Offers Combination Curing Agent and Flexibilizer For Epoxy Resins

The Harchem Division of Wallace & Tiernan, Inc. is introducing a linear polymeric anhydride that functions as a flexibilizer as well as curing agent for epoxy resins.

Called "Harcure A," it imparts excellent thermal shock properties as well as good high temperature electrical properties to cured epoxy recipes.

"Harcure A" can be formulated with liquid or solid epoxy resins into a single component system with prolonged shelf life at room temperature.

According to Harchem officials, this revolutionary curing agent is already available in recipes offered by a number of leading epoxy formulators.

Data and samples are available through the product development department, Harchem division, Wallace & Tiernan, Inc., 25 Main St., Belleville 9, N. J.

New Revised Edition of "Fatty Acids" Available

The new revised edition of *Fatty Acids* is now available through Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, New York. Enlarged to include modern production methods and applications, the book is in four parts and covers chemistry, properties, production and uses. It is edited by Klare S. Markley and Part 1 sells for $22.50.

The second edition represents a complete rewriting of the original work, and special emphasis is given to those developments which have occurred and assumed practical importance since the first edition came out in 1947. Part 1 is available now and contains in 724 pages the first seven of the 24 chapters of the new edition. Part 2 will be offered in the spring, while Part 3 and Part 4 are in preparation.

Introduces New Bulk Grease Carrier

A new piece of equipment will be introduced shortly to Esso Standard's industrial customers. Soon many deliveries of grease will be made in bulk, the efficient method of transporting such material in truck-load quantities. Shipments will be made out of Pittsburgh and Baltimore to industrial plants equipped with bulk storage facilities.

In addition to making grease available to consumers at lower cost, this new system of delivery will allow many concerns to take advantage of the greater economy that bulk handling of grease offers. In the customer's plant, it will reduce grease contamination, save floor space, improve cleanliness and eliminate the need for handling drums—the grease being piped direct from storage tank to the centralized lubrication system.

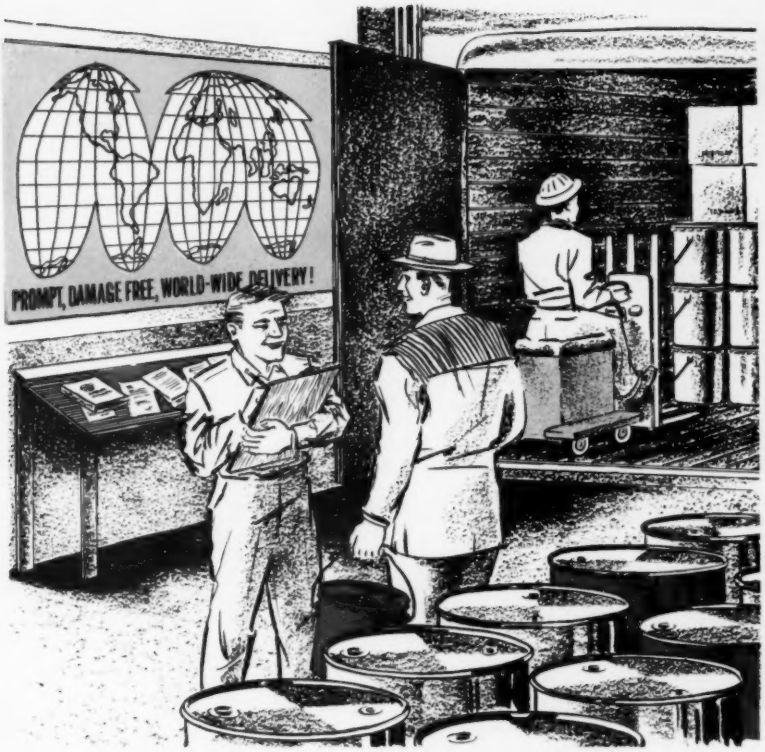
The new bulk grease carrier, built in accordance with the most advanced design, has a semi-trailer body which carries three grease compartments or canisters, each with a capacity of approximately 10,500 pounds. One, two or three types of grease can be shipped at a time with no chance of any intermixing.

To maintain purity of the grease and to assure full delivery, the cylindrical canisters are emptied clean at each unloading. Insulation helps keep the grease at the proper unloading temperature, and conical canister bottoms promote complete removal. Conical follower plates wipe the canister walls clean.

The bottom outlet of each canister is connected to the suction side of its individual pump driven hydraulically by a gasoline engine mounted on the trailer. It will unload a full canister in less than a half hour. The three separate pumps eliminate manifolding—along with the possibility of grease contamination.

For plants whose grease consumption justifies the installation of bulk facilities, conversion is often quite simple. It may require only the addition of storage tanks and pumps which can be connected to an existing centralized system.

The grease plants at Pittsburgh and Baltimore have been operated by Esso Standard in the past. But with the reorganization plan recently announced by Humble, all refineries and other manufacturing units were consolidated into a new Manufacturing division of the Humble company. Esso, which had been the Esso Standard Div. of Humble, was redesignated as "Esso Standard, Eastern Region"—one of four geographic regions which are in charge of exploration, producing and marketing activities for Humble. The Manufacturing division was one of three functional divisions which were designated at the same time. It will have its headquarters in Houston.



BRANDS always look "BRAND NEW"

when manufactured • packaged and shipped by SOWESCO . . . the House of "Good" Grease

WHETHER . . .

- by Sowesco's large, privately owned truck fleet
- by closely coordinated common carrier truck
- by expedited full carload rail service at low "in-transit" freight rates
- by versatile, carefully coordinated pooled carloads

World-wide shipments of SOWESCO Products get where they're going — on time . . . and damage free.

Yes, brands always look "brand new" when they reach SOWESCO customers.

At SOWESCO, a carefully organized team of skilled shipping specialists, using the above-described wide variety of delivery alternatives, coupled with a highly automated handling system, move SOWESCO Products from warehouse to customer with the considered care and concern of people who understand the critical importance **of prompt, damage-free deliveries.**

Every year these carefully trained specialists efficiently expedite the handling of over 120,000,000 pounds of assorted lubricant products and specialties — an average of approximately 200 tons daily. It's a big job and an important one . . . and the careful attention to it is only another example of the **many hidden value factors** built into every one of SOWESCO's products . .

These are good reasons why we at SOWESCO, the House of "GOOD" Grease, again recommend that progressive branded lubricant marketers . . . **look behind the product** . . . for the "HIDDEN VALUE FACTORS."

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Your inquiries are all enthusiastically received and promptly handled.

SPECIALIZING IN THE CUSTOM MANUFACTURE OF PETROLEUM LUBRICATING GREASES AND SPECIALTIES

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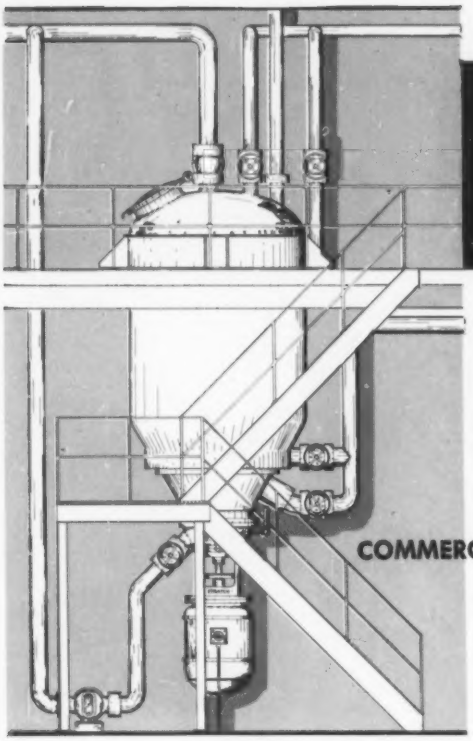
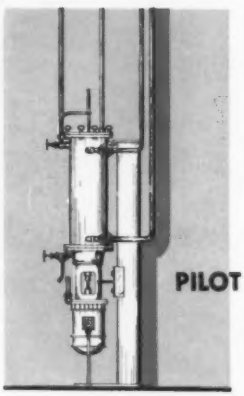
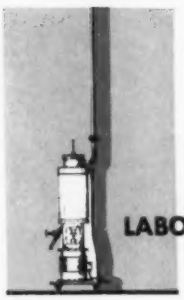


COMMERCIAL

- **Simplify Production**
- **Reduce Costs**
- **Produce More Uniform Greases**



PILOT



LABORATORY

Used in a complete Stratco Installation or as units in existing plants, Stratco Contactors provide continuous or batch mixing with very short time cycles, less soap, less laboratory control.

They replace other less efficient equipment, simplify plant layout, make possible either increased production or fewer man hours of operation.

Available in three types as illustrated so experimental and pilot plant results can be used for the formulation and plant guidance of full scale commercial equipment. Intermediate sizes to meet all requirements. Write for details.

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